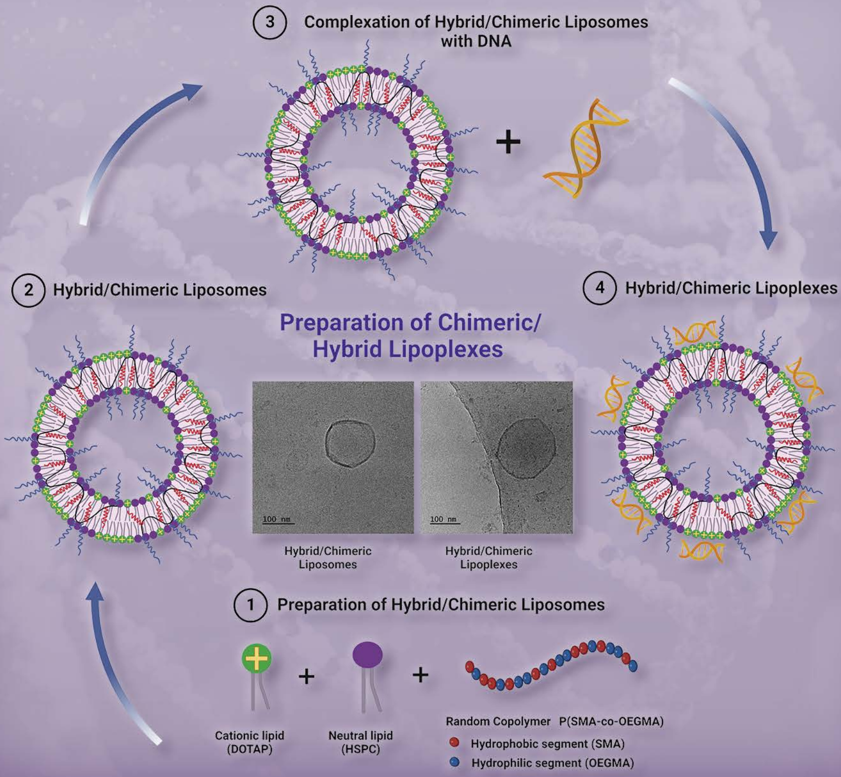
polymers

IMPACT FACTOR 4.967

Indexed in: PubMed



Amphiphilic Copolymer-Lipid Chimeric Nanosystems as DNA Vectors

Volume 14 · Issue 22 | November (II) 2022

MDPI

mdpi.com/journal/polymers
ISSN 2073-4360

polymers (/journal/polymers) IMPACT FACTOR 4.967 Indexed in: PubMed (https://www.ncbi.nlm.nih.gov/pubmed/?term=2073-4360)

Journal Menu

Journal Browser

Editorial Board

Members (929)

Search by first name, last name, affiliation, i

Back to TopTop

Back to TopTop

Prof. Dr. Katja Loos (https://sciprofiles.com/profile/13141)
Website (https://www.rug.nl/staff/k.u.loos/)
Advisory Board Member
Macromolecular Chemistry and New Polymeric Materials, Zernike Institute for Advanced Materials, University of Groningen, Nijenborgh 4, 9747 AG Groningen, The Netherlands
Interests: biocatalysis in polymer chemistry; enzymatic polymerizations; green polymer chemistry; biocatalytic monomer synthesis; biocatalytic polymer modification; enzyme immobilization; unraveling the mechanism of biocatalytic polymerizations; biobased monomers and polymers; sustainability; polysaccharides; starch; anionic polymerization; controlled radical polymerization; block copolymer synthesis; supramolecular assembly; block copolymer self-assembly
Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Nadia Lotti (https://sciprofiles.com/profile/127609)
Website (https://www.unibo.it/sitoweb/nadia.lotti)
Advisory Board Member
1. Department of Civil, Chemical, Environmental and Materials Engineering of the University of Bologna, Bologna, Italy
2. Industrial Research Advanced Materials for the Design and Photonic Applications (CIRI-MAM), University of Bologna, Bologna, Italy
3. Interdepartmental Centre of Industrial Agrifood Research (CIRI–Agrifood), University of Bologna, Bologna, Italy
Interests: eco-friendly polymers for sustainable food packaging, green building and coatings; synthesis and characterization of novel polymeric materials for biomedical applications; study of polymer crystallization process; complex analyses of dynamic phenomena and of polymeric material structure; preparation and characterization of "eco-friendly nanocomposites" for food packaging and biomedical applications; synthesis and characterization of novel S-S containing polyesters; synthesis and characterization of bio-based polyureas; valorization of agro-food waste; biodegradation studies in soil, marine environment and compost
Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Ian Manners
Website (https://web.uvic.ca/~imanners/home.html)
Advisory Board Member
Department of Chemistry, University of Victoria, Victoria, BC V8W 3 V6, Canada
Interests: polymer and materials science; catalysis; self-assembly; nanoscience; inorganic chemistry

Prof. Dr. Krzysztof Matyjaszewski (https://sciprofiles.com/profile/640541)
★ (https://clarivate.com/highly-cited-researchers/2022) Website (https://www.cmu.edu/maty/)
Advisory Board Member
Department of Chemistry, Carnegie Mellon University, Pittsburgh, PA 15213, USA
Interests: chemistry; polymers; polymer chemistry; polymer science; materials

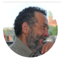
Prof. Dr. David Mecerreyes (https://sciprofiles.com/profile/76670)
Website (http://www.polymat.eu/en/people/jefes-de-grupo/david-mecerreyes)
Advisory Board Member
POLYMAT, Joxe Mari Korta Center, University of the Basque Country UPV/EHU, Avda. Tolosa 72, 20018 Donostia-San Sebastian, Spain
Interests: Innovative polymer chemistry; polymeric ionic liquids; redox polymers; polymers for energy (batteries)
Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Goerg H. Michler (https://sciprofiles.com/profile/11662)
Website (http://www.physik.uni-halle.de/aww/index.htm)
Advisory Board Member
Institut für Polymerwerkstoffe e.V. (IPW), Eberhard-Leibnitz-Straße 2, D-06217 Merseburg/Saale, Germany
Interests: electron microscopy (including SEM, TEM); atomic force microscopy (AFM); morphology of polymers; micromechanical poperties; nanostructured polymers; toughness enhancement; nanocomposites; biomedical polymers

Prof. Dr. Kell Mortensen
Website (http://www.nbi.dk/~kell/)
Advisory Board Member
Niels Bohr Institute, University of Copenhagen, Universitetsparken 5, 2100 Copenhagen, Denmark
Interests: materials sciences; biomolecules and polymers; molecular self-assembly; soft matter science; biomembrane; synthetic biology; X-ray and neutron scattering

Prof. Dr. Klaus Müllen (https://sciprofiles.com/profile/11661)
★ (https://recognition.webofsciencegroup.com/awards/highly-cited/2020/) Website (https://www.mpg.de/369516/polymer-research-muellen)
Advisory Board Member
Max Planck Institute for Polymer Research, Ackermannweg 10, D-55128 Mainz, Germany
Interests: new polymer-forming reactions including methods of organometallic chemistry; multi-dimensional polymers with complex shape-persistent architectures; functional polymeric networks, in particular for catalytic purposes; dyes and laser writing into polymers; chemistry and physics of single molecules; molecular materials with liquid crystalline properties for electronic and optoelectronic devices; materials for lithium or hydrogen storage; biosynthetic hybrids; nanocomposites
Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Chul B. Park (https://sciprofiles.com/profile/373871)
Website (https://www.mie.utoronto.ca/faculty_staff/park/)
Advisory Board Member
Department of Mechanical and Industrial Engineering, University of Toronto, 5 King's College Road, Toronto, ON M5S 3G8, Canada
Interests: plastic foaming technology; fundamental understanding of foaming phenomena; computational modeling of foaming; super high R value foams; sound insulation foams, biodegradable foams; environmentally safe blowing agents
Special Issues, Collections and Topics in MDPI journals



Prof. Dr. Polycarpos Pissis (https://sciprofiles.com/profile/12048)
Website (http://www.physics.ntua.gr)
Advisory Board Member

Back to TopTop

Back to TopTop

Back to TopTop

Back to TopTop

Prof. Dr. Zbigniew Bartczak (https://sciprofiles.com/profile/388232)
Website (https://www.cbmm.lodz.pl/)
Section Board Member
Centre of Molecular and Macromolecular Studies, Polish Academy of Sciences, Division of Polymers, Sienkiewicza 112, 90-363 Lodz, Poland
Interests: structure and properties of crystalline polymers; plastic deformation and orientation of polymeric materials; polymer blends and composites; crystallization of polymers nanocompounds

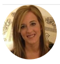
Dr. Matthias Barz (https://sciprofiles.com/profile/213434)
Website (https://barzlab.com/dr-rer-nat-matthias-barz/)
Section Board Member
Institute of Organic Chemistry, Johannes Gutenberg-Universität Mainz, Mainz, Germany
Interests: Polypeptides; polypeptoids; polypept(o)ides; nanomedicine; in vivo click chemistry; disulfide chemistry; secondary structure directed solution self-assembly

Prof. Dr. Giuseppe Battaglia (https://sciprofiles.com/profile/853061)
Website (https://www.molecularbionics.org)
Section Board Member
Department of Chemistry, Department of Chemical Engineering, Institute of Physics of Living System, University College London, London, UK
Interests: nanomedicine; drug delivery; physical biology; active matter; self assembly; vesicles; biodegradable and biocompatible polymers; transmission electron microscopy

Prof. Dr. Emin Bayraktar (https://sciprofiles.com/profile/409365)
Website (http://lismma.supmeca.fr/?q=node/4472)
Section Board Member
School of Mechanical and Manufacturing Engineering, Supmeca-Paris, 3 rue Fernand Hainaut, 93400 Saint Ouen, France
Interests: advanced manufacturing processes (sinter forging, thixoforming); damage mechanisms of materials (metallic, intermetallic, rubber and epoxy-based composites); design of new composites and damage characterization; design and manufacturing of recycled constituent composites
Special Issues, Collections and Topics in MDPI journals

Dr. Emiliano Bedini (https://sciprofiles.com/profile/270315)
Website (https://www.researchgate.net/profile/Emiliano_Bedini)
Section Board Member
Department of Chemical Sciences, Università degli Studi di Napoli Federico II, ComplessoUniversitario Monte S.Angelo, via Cintia 4, I-80126 Napoli, Italy
Interests: semi-synthetic polysaccharides; sulfated polysaccharides; NMR of polysaccharides; protecting groups in polysaccharide chemistry
Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Mario Beiner (https://sciprofiles.com/profile/1405696)
Website1 (https://www.imws.fraunhofer.de/de/presse/news/Fraunhofer-PAZ-am-Chemiestandort-Schkopau.html) **Website2 (https://www.chemie.uni-halle.de/bereiche_der_chemie/technische_chemie/ak_weidisch/mitarbeiter/mariobeiner/?lang=de)**
Section Board Member
1. Fraunhofer Institute for Microstructure of Materials and Systems IMWS, D-06120 Halle, Germany
2. Naturwissenschaftliche Fakultät II, Martin-Luther-Universität Halle-Wittenberg, D-06120 Halle, Germany
Interests: polymer dynamics; glass transition; polymer crystallization; micro- and nanophase separation in polymers; rubber composites



Dr. Ana Beltrán Sanahuja (https://sciprofiles.com/profile/239863)
Website (https://www.researchgate.net/profile/A_Sanahuja)
Section Board Member
Analytical Chemistry, Nutrition & Food Sciences Dept., University of Alicante, 03690 Alicante, Spain
Interests: active food packaging; polymers characterization; analytical chemistry; food chemistry; food authentication, food waste reduction, polyphenols; volatile composition; antioxidant activity; oxidative stability of foods
Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Sidi A. Bencherif (https://sciprofiles.com/profile/233397)
Website (https://coe.northeastern.edu/people/bencherif-sidi/)
Section Board Member
Department of Chemical Engineering, Northeastern University, Boston, MA 02115, USA
Interests: biomaterials; cryogels; drug delivery; tissue engineering; cancer immunotherapy
Special Issues, Collections and Topics in MDPI journals

Dr. Maria Bercea (https://sciprofiles.com/profile/1152050)
Website (https://mariabercea.wordpress.com/)
Section Board Member
"Petru Poni" Institute of Macromolecular Chemistry of Romanian Academy, 41 A, Grigore Ghica Voda Alley, 700487 Iasi, Romania
Interests: thermodynamic and rheological approaches for polymer-containing systems; conformational characteristics of polymers in solution; viscoelastic behavior of macromolecules in different flow conditions; soft materials—solutions, suspensions, hydrogels; stimuli-responsive (bio)materials; porous membranes; self-assembling phenomena
Special Issues, Collections and Topics in MDPI journals

Dr. Paola Bernardo (https://sciprofiles.com/profile/479041)
Website (https://www.researchgate.net/profile/Paola_Bernardo)
Section Board Member
Institute on Membrane Technology, ITM-CNR (c/o University of Calabria), Via P. Bucci 17/C, 87036 Rende (CS), Italy
Interests: study of the transport properties of gas and vapours in nanocomposite and nanostructured membranes; preparation and characterization of dense, asymmetric and composite polymeric membranes for gas separation, as flat sheets or hollow fibers.; structure-Property Correlations and macroscopic modeling for nanocomposite membranes;

Back to TopTop

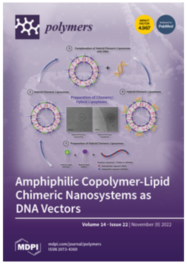
mesomorphic behaviour; soft matter
MDPI (/)

(/toggle_desktop_layout_cookie)

Back to TopTop

***Polymers* (/journal/polymers)**, EISSN 2073-4360, Published by MDPI

Polymers, Volume 14, Issue 22 (November-2 2022) – 266 articles



(https://www.mdpi.com/2073-4360/14/22/4901)

Cover Story (**view full-size image (/files/uploaded/covers/polymers/big_cover-polymers-v14-i22.png)**): Gene therapy is one of the most promising strategies for the treatment of a broad range of genetic-based diseases. Therefore, the design of effective gene delivery systems is required. In this study, novel lipid-amphiphilic copolymer chimeric (hybrid) nanosystems were developed and explored from the physicochemical point of view regarding their potential as non-viral vectors for nucleic acid delivery. **View this paper (https://www.mdpi.com/2073-4360/14/22/4901)**

- Issues are regarded as officially published after their release is announced to the **table of contents alert mailing list (/journal/polymers/toc-alert)**.
- You may **sign up for e-mail alerts (/journal/polymers/toc-alert)** to receive table of contents of newly released issues.
- PDF is the official format for papers published in both, html and pdf forms. To view the papers in pdf format, click on the "PDF Full-text" link, and use the free **Adobe Reader (http://www.adobe.com/)** to open them.

Order results

Publication Date

Result details

Compact

Section

All Sections

Show export options

Open Access Article (/2073-4360/14/22/5053/pdf?version=1669112296)

Low Molecular Weight Bio-Polyamide 11 Composites Reinforced with Flax and Intraply Flax/Basalt Hybrid Fabrics for Eco-Friendlier Transportation Components (/2073-4360/14/22/5053)

Polymers **2022**, *14*(22), 5053; **https://doi.org/10.3390/polym14225053 (https://doi.org/10.3390/polym14225053)** - 21 Nov 2022

Open Access Article (/2073-4360/14/22/5052/pdf?version=1669120683)

Norbornene as Key for a Possible Efficient Chemical Recycling in Structures Based on Ethylene (/2073-4360/14/22/5052)

Polymers **2022**, *14*(22), 5052; **https://doi.org/10.3390/polym14225052 (https://doi.org/10.3390/polym14225052)** - 21 Nov 2022

Open Access Article (/2073-4360/14/22/5051/pdf?version=1669104308)

Dynamic Response of Components Containing Polymer Composites in the Resonance Region for Vibration Amplitudes up to 5g (/2073-4360/14/22/5051)

Polymers **2022**, *14*(22), 5051; **https://doi.org/10.3390/polym14225051 (https://doi.org/10.3390/polym14225051)** - 21 Nov 2022

Open Access Article (/2073-4360/14/22/5050/pdf?version=1669107733)

A Systematic Investigation of Polymer Influence on Core Scale Wettability Aided by Positron Emission Tomography Imaging (/2073-4360/14/22/5050)

Polymers **2022**, *14*(22), 5050; **https://doi.org/10.3390/polym14225050 (https://doi.org/10.3390/polym14225050)** - 21 Nov 2022

Open Access Article (/2073-4360/14/22/5049/pdf?version=1669123374)

Electrospun Sound-Absorbing Nanofibrous Webs from Recycled Poly(vinyl butyral) (/2073-4360/14/22/5049)

Polymers **2022**, *14*(22), 5049; **https://doi.org/10.3390/polym14225049 (https://doi.org/10.3390/polym14225049)** - 21 Nov 2022

Open Access Article (/2073-4360/14/22/5048/pdf?version=1669028270)

The Electrical Conductivity and Mechanical Properties of Monolayer and Multilayer Nanofibre Membranes from Different Fillers: Calculated Based on Parallel Circuit (/2073-4360/14/22/5048)

Polymers **2022**, *14*(22), 5048; **https://doi.org/10.3390/polym14225048 (https://doi.org/10.3390/polym14225048)** - 21 Nov 2022

Open Access Article (/2073-4360/14/22/5047/pdf?version=1669038677)

Development and Mechanical Characterization of Short Curauá Fiber-Reinforced PLA Composites Made via Fused Deposition Modeling (/2073-4360/14/22/5047)

Polymers **2022**, *14*(22), 5047; **https://doi.org/10.3390/polym14225047 (https://doi.org/10.3390/polym14225047)** - 21 Nov 2022

Open Access Review (/2073-4360/14/22/5046/pdf?version=1669031627)

One-Part Alkali-Activated Materials: State of the Art and Perspectives (/2073-4360/14/22/5046)

Polymers **2022**, *14*(22), 5046; **https://doi.org/10.3390/polym14225046 (https://doi.org/10.3390/polym14225046)** - 21 Nov 2022

Open Access Article (/2073-4360/14/22/5045/pdf?version=1669022431)

Moisture-Related Shrinkage Behavior of Wood at Macroscale and Cellular Level (/2073-4360/14/22/5045)

Polymers **2022**, *14*(22), 5045; **https://doi.org/10.3390/polym14225045 (https://doi.org/10.3390/polym14225045)** - 21 Nov 2022

Open Access Article (/2073-4360/14/22/5044/pdf?version=1669111431)

The EDLC Energy Storage Device Based on a Natural Gelatin (NG) Biopolymer: Tuning the Capacitance through Plasticizer Variation (/2073-4360/14/22/5044)

Polymers **2022**, *14*(22), 5044; **https://doi.org/10.3390/polym14225044 (https://doi.org/10.3390/polym14225044)** - 21 Nov 2022

Open Access Article (/2073-4360/14/22/5043/pdf?version=1669022178)

Inkjet Printing of Electrodes on Electrospun Micro- and Nanofiber Hydrophobic Membranes for Flexible and Smart Textile Applications (/2073-4360/14/22/5043)

Polymers **2022**, *14*(22), 5043; **https://doi.org/10.3390/polym14225043 (https://doi.org/10.3390/polym14225043)** - 21 Nov 2022

Open Access Article (/2073-4360/14/22/5042/pdf?version=1669109385)

Development of Smart Bilayer Alginate/Agar Film Containing Anthocyanin and Catechin-Lysozyme (/2073-4360/14/22/5042)

Polymers **2022**, *14*(22), 5042; **https://doi.org/10.3390/polym14225042 (https://doi.org/10.3390/polym14225042)** - 21 Nov 2022

Open Access Article (/2073-4360/14/22/5041/pdf?version=1669018635)

Characterization of the Mechanical and Morphological Properties of Cow Dung Fiber-Reinforced Polymer Composites: A Comparative Study with Corn Stalk Fiber Composites and Sisal Fiber Composites (/2073-4360/14/22/5041)

Polymers **2022**, *14*(22), 5041; **https://doi.org/10.3390/polym14225041 (https://doi.org/10.3390/polym14225041)** - 21 Nov 2022

Open Access Article (/2073-4360/14/22/5040/pdf?version=1669018143)

Ascorbic Acid-Modified Silicones: Crosslinking and Antioxidant Delivery (/2073-4360/14/22/5040)

Polymers **2022**, *14*(22), 5040; **https://doi.org/10.3390/polym14225040 (https://doi.org/10.3390/polym14225040)** - 21 Nov 2022

Open Access Article (/2073-4360/14/22/5039/pdf?version=1669018925)

Warmforming Flow Pressing Characteristics of Continuous Fibre Reinforced Thermoplastic Composites (/2073-4360/14/22/5039)

Polymers **2022**, *14*(22), 5039; **https://doi.org/10.3390/polym14225039 (https://doi.org/10.3390/polym14225039)** - 21 Nov 2022

Open Access Article (/2073-4360/14/22/5038/pdf?version=1676519984)

Novel Polymeric Nanomaterial Based on Poly(Hydroxyethyl Methacrylate-Methacryloylamidophenylalanine) for Hypertension Treatment: Properties and Drug Release Characteristics (/2073-4360/14/22/5038)

Polymers **2022**, *14*(22), 5038; **https://doi.org/10.3390/polym14225038 (https://doi.org/10.3390/polym14225038)** - 21 Nov 2022

Open Access Article (/2073-4360/14/22/5037/pdf?version=1669017242)

APTES-Modified Nanocellulose as the Formaldehyde Scavenger for UF Adhesive-Bonded Particleboard and Strawboard (/2073-4360/14/22/5037)

Polymers **2022**, *14*(22), 5037; **https://doi.org/10.3390/polym14225037 (https://doi.org/10.3390/polym14225037)** - 21 Nov 2022

Open Access Article (/2073-4360/14/22/5036/pdf?version=1669020991)

Core/Double-Sheath Composite Fibers from Poly(ethylene oxide), Poly(L-lactide) and Beeswax by Single-Spinneret Electrospinning (/2073-4360/14/22/5036)

Polymers **2022**, *14*(22), 5036; **https://doi.org/10.3390/polym14225036 (https://doi.org/10.3390/polym14225036)** - 21 Nov 2022

Open Access Article (/2073-4360/14/22/5035/pdf?version=1669009613)

Pyrolysis of Denim Jeans Waste: Pyrolytic Product Modification by the Addition of Sodium Carbonate (/2073-4360/14/22/5035)

Polymers **2022**, *14*(22), 5035; **https://doi.org/10.3390/polym14225035 (https://doi.org/10.3390/polym14225035)** - 21 Nov 2022

Open Access Article (/2073-4360/14/22/5034/pdf?version=1669102156)

Human Umbilical Vein Endothelial Cells Form a Network on a Hyaluronic Acid/Gelatin Composite Hydrogel Moderately Crosslinked and Degraded by Hydrogen Peroxide (/2073-4360/14/22/5034)

Polymers **2022**, *14*(22), 5034; **https://doi.org/10.3390/polym14225034 (https://doi.org/10.3390/polym14225034)** - 20 Nov 2022

Open Access Article (/2073-4360/14/22/5033/pdf?version=1669170227)

[Sustainable PHBH–Alumina Nanowire Nanocomposites: Properties and Life Cycle Assessment (/2073-4360/14/22/5033)]

Polymers **2022**, *14*(22), 5033; https://doi.org/10.3390/polym14225033 (https://doi.org/10.3390/polym14225033) - 20 Nov 2022

Open Access Article (/2073-4360/14/22/5032/pdf?version=1669118969)

[Molecular Dynamics Simulation of the Interfacial Shear Properties between Thermoplastic Polyurethane and Functionalized Graphene Sheet (/2073-4360/14/22/5032)]

Polymers **2022**, *14*(22), 5032; https://doi.org/10.3390/polym14225032 (https://doi.org/10.3390/polym14225032) - 20 Nov 2022

Open Access Article (/2073-4360/14/22/5031/pdf?version=1668931740)

[Swelling and Collapse of Cylindrical Polyelectrolyte Microgels (/2073-4360/14/22/5031)]

Polymers **2022**, *14*(22), 5031; https://doi.org/10.3390/polym14225031 (https://doi.org/10.3390/polym14225031) - 20 Nov 2022

Open Access Article (/2073-4360/14/22/5030/pdf?version=1668931532)

[Facile Fabrication of a Bio-Inspired Leaf Vein-Based Ultra-Sensitive Humidity Sensor with a Hygroscopic Polymer (/2073-4360/14/22/5030)]

Polymers **2022**, *14*(22), 5030; https://doi.org/10.3390/polym14225030 (https://doi.org/10.3390/polym14225030) - 20 Nov 2022

Open Access Article (/2073-4360/14/22/5029/pdf?version=1669103326)

[Synthesis and Characterization of PU/PLCL/CMCS Electrospun Scaffolds for Skin Tissue Engineering (/2073-4360/14/22/5029)]

Polymers **2022**, *14*(22), 5029; https://doi.org/10.3390/polym14225029 (https://doi.org/10.3390/polym14225029) - 19 Nov 2022

Open Access Article (/2073-4360/14/22/5028/pdf?version=1668861383)

[Poly(Glycerol Succinate) as Coating Material for 1393 Bioactive Glass Porous Scaffolds for Tissue Engineering Applications (/2073-4360/14/22/5028)]

Polymers **2022**, *14*(22), 5028; https://doi.org/10.3390/polym14225028 (https://doi.org/10.3390/polym14225028) - 19 Nov 2022

Open Access Article (/2073-4360/14/22/5027/pdf?version=1668852294)

[Impact of Particle and Crystallite Size of $Ba_{0.6}Sr_{0.4}TiO_3$ on the Dielectric Properties of BST/P(VDF-TrFE) Composites in Fully Printed Varactors (/2073-4360/14/22/5027)]

Polymers **2022**, *14*(22), 5027; https://doi.org/10.3390/polym14225027 (https://doi.org/10.3390/polym14225027) - 19 Nov 2022

Open Access Article (/2073-4360/14/22/5026/pdf?version=1668912855)

[Design and Ballistic Performance of Hybrid Plates Manufactured from Aramid Composites for Developing Multilayered Armor Systems (/2073-4360/14/22/5026)]

Polymers **2022**, *14*(22), 5026; https://doi.org/10.3390/polym14225026 (https://doi.org/10.3390/polym14225026) - 19 Nov 2022

Open Access Article (/2073-4360/14/22/5025/pdf?version=1669098694)

[Development of Water Repellent, Non-Friable Tannin-Furanic-Fatty Acids Biofoams (/2073-4360/14/22/5025)]

Polymers **2022**, *14*(22), 5025; https://doi.org/10.3390/polym14225025 (https://doi.org/10.3390/polym14225025) - 19 Nov 2022

Open Access Article (/2073-4360/14/22/5024/pdf?version=1669217153)

[Temperature Controlled Mechanical Reinforcement of Polyacrylate Films Containing Nematic Liquid Crystals (/2073-4360/14/22/5024)]

Polymers **2022**, *14*(22), 5024; https://doi.org/10.3390/polym14225024 (https://doi.org/10.3390/polym14225024) - 19 Nov 2022

Open Access Article (/2073-4360/14/22/5023/pdf?version=1669106870)

[Magnetic Resonance Imaging: Time-Dependent Wetting and Swelling Behavior of an Auxetic Hydrogel Based on Natural Polymers (/2073-4360/14/22/5023)]

Polymers **2022**, *14*(22), 5023; https://doi.org/10.3390/polym14225023 (https://doi.org/10.3390/polym14225023) - 19 Nov 2022

Open Access Article (/2073-4360/14/22/5022/pdf?version=1669109375)

[Preparation and Phytotoxicity Evaluation of Cellulose Acetate Nanoparticles (/2073-4360/14/22/5022)]

Polymers **2022**, *14*(22), 5022; https://doi.org/10.3390/polym14225022 (https://doi.org/10.3390/polym14225022) - 19 Nov 2022

Open Access Article (/2073-4360/14/22/5021/pdf?version=1668846977)

[Effect of Colorants and Process Parameters on the Properties of Dope-Dyed Polylactic Acid Multifilament Yarns (/2073-4360/14/22/5021)]

Polymers **2022**, *14*(22), 5021; https://doi.org/10.3390/polym14225021 (https://doi.org/10.3390/polym14225021) - 19 Nov 2022

Open Access Article (/2073-4360/14/22/5020/pdf?version=1669276281)

[Multi-Shaded Edible Films Based on Gelatin and Starch for the Packaging Applications (/2073-4360/14/22/5020)]

Polymers **2022**, *14*(22), 5020; https://doi.org/10.3390/polym14225020 (https://doi.org/10.3390/polym14225020) - 19 Nov 2022

Open Access Article (/2073-4360/14/22/5019/pdf?version=1668840886)

[Non-Isocyanate Polyurethane Bio-Foam with Inherent Heat and Fire Resistance (/2073-4360/14/22/5019)]

Polymers **2022**, *14*(22), 5019; https://doi.org/10.3390/polym14225019 (https://doi.org/10.3390/polym14225019) - 19 Nov 2022

Open Access Article (/2073-4360/14/22/5018/pdf?version=1669109638)

Development of Bioactive *Opuntia ficus-indica* Edible Films Containing Probiotics as a Coating for Fresh-Cut Fruit (/2073-4360/14/22/5018)

Polymers **2022**, *14*(22), 5018; **https://doi.org/10.3390/polym14225018 (https://doi.org/10.3390/polym14225018)** - 18 Nov 2022

Open Access Article (/2073-4360/14/22/5017/pdf?version=1669097373)

Height-to-Diameter Ratio and Porosity Strongly Influence Bulk Compressive Mechanical Properties of 3D-Printed Polymer Scaffolds (/2073-4360/14/22/5017)

Polymers **2022**, *14*(22), 5017; **https://doi.org/10.3390/polym14225017 (https://doi.org/10.3390/polym14225017)** - 18 Nov 2022

Open Access Editor's Choice Article (/2073-4360/14/22/5016/pdf?version=1668780814)

The Influence of Different Sustainable Silk-Based Fillers on the Thermal and Mechanical Properties of Polylactic Acid Composites (/2073-4360/14/22/5016)

Polymers **2022**, *14*(22), 5016; **https://doi.org/10.3390/polym14225016 (https://doi.org/10.3390/polym14225016)** - 18 Nov 2022

Open Access Article (/2073-4360/14/22/5015/pdf?version=1669254433)

Optimal Surface Pre-Reacted Glass Filler Ratio in a Dental Varnish Effective for Inhibition of Biofilm-Induced Root Dentin Demineralization (/2073-4360/14/22/5015)

Polymers **2022**, *14*(22), 5015; **https://doi.org/10.3390/polym14225015 (https://doi.org/10.3390/polym14225015)** - 18 Nov 2022

Open Access Review (/2073-4360/14/22/5014/pdf?version=1668776066)

The Alterations and Roles of Glycosaminoglycans in Human Diseases (/2073-4360/14/22/5014)

Polymers **2022**, *14*(22), 5014; **https://doi.org/10.3390/polym14225014 (https://doi.org/10.3390/polym14225014)** - 18 Nov 2022

Open Access Article (/2073-4360/14/22/5013/pdf?version=1669104010)

Evolution of Molar Mass Distributions Using a Method of Partial Moments: Initiation of RAFT Polymerization (/2073-4360/14/22/5013)

Polymers **2022**, *14*(22), 5013; **https://doi.org/10.3390/polym14225013 (https://doi.org/10.3390/polym14225013)** - 18 Nov 2022

Open Access Article (/2073-4360/14/22/5012/pdf?version=1668769653)

A Salt-Resistant Sodium Carboxymethyl Cellulose Modified by the Heterogeneous Process of Oleate Amide Quaternary Ammonium Salt (/2073-4360/14/22/5012)

Polymers **2022**, *14*(22), 5012; **https://doi.org/10.3390/polym14225012 (https://doi.org/10.3390/polym14225012)** - 18 Nov 2022

Open Access Article (/2073-4360/14/22/5011/pdf?version=1668767391)

Structural Characterization and Optimization of a Miconazole Oral Gel (/2073-4360/14/22/5011)

Polymers **2022**, *14*(22), 5011; **https://doi.org/10.3390/polym14225011 (https://doi.org/10.3390/polym14225011)** - 18 Nov 2022

Open Access Review (/2073-4360/14/22/5010/pdf?version=1668777814)

Upcycling Polystyrene (/2073-4360/14/22/5010)

Polymers **2022**, *14*(22), 5010; **https://doi.org/10.3390/polym14225010 (https://doi.org/10.3390/polym14225010)** - 18 Nov 2022

Open Access Article (/2073-4360/14/22/5009/pdf?version=1669196354)

A Feasible Compatibilization Processing Technique for Improving the Mechanical and Thermal Performance of Rubbery Biopolymer/Graphene Nanocomposites (/2073-4360/14/22/5009)

Polymers **2022**, *14*(22), 5009; **https://doi.org/10.3390/polym14225009 (https://doi.org/10.3390/polym14225009)** - 18 Nov 2022

Open Access Systematic Review (/2073-4360/14/22/5008/pdf?version=1669083030)

Knowledge Mapping of the Literature on Fiber-Reinforced Geopolymers: A Scientometric Review (/2073-4360/14/22/5008)

Polymers **2022**, *14*(22), 5008; **https://doi.org/10.3390/polym14225008 (https://doi.org/10.3390/polym14225008)** - 18 Nov 2022

Open Access Review (/2073-4360/14/22/5007/pdf?version=1669005879)

Scientific Advancements in Composite Materials for Aircraft Applications: A Review (/2073-4360/14/22/5007)

Polymers **2022**, *14*(22), 5007; **https://doi.org/10.3390/polym14225007 (https://doi.org/10.3390/polym14225007)** - 18 Nov 2022

Open Access Article (/2073-4360/14/22/5006/pdf?version=1668765490)

The Effect of Chitosan on Plant Physiology, Wound Response, and Fruit Quality of Tomato (/2073-4360/14/22/5006)

Polymers **2022**, *14*(22), 5006; **https://doi.org/10.3390/polym14225006 (https://doi.org/10.3390/polym14225006)** - 18 Nov 2022

Open Access Article (/2073-4360/14/22/5005/pdf?version=1669274732)

Influence of Initiator Concentration on the Polymerization Course of Methacrylate Bone Cement (/2073-4360/14/22/5005)

Polymers **2022**, *14*(22), 5005; **https://doi.org/10.3390/polym14225005 (https://doi.org/10.3390/polym14225005)** - 18 Nov 2022

Open Access Review (/2073-4360/14/22/5004/pdf?version=1668765285)

A Critical Review on the Feasibility of Synthetic Polymers Inclusion in Enhancing the Geotechnical Behavior of Soils (/2073-4360/14/22/5004)

Polymers **2022**, *14*(22), 5004; **https://doi.org/10.3390/polym14225004 (https://doi.org/10.3390/polym14225004)** - 18 Nov 2022

Open Access Article (/2073-4360/14/22/5003/pdf?version=1668764544)

Pyrolysis of *Aesculus chinensis* Bunge Leaves as for Extracted Bio-Oil Material (/2073-4360/14/22/5003)

Polymers **2022**, *14*(22), 5003; https://doi.org/10.3390/polym14225003 (https://doi.org/10.3390/polym14225003) - 18 Nov 2022

Open Access Feature Paper Editor's Choice Article (/2073-4360/14/22/5002/pdf?version=1668995154)

Bio-Based Electrospun Fibers from Chitosan Schiff Base and Polylactide and Their Cu^{2+} and Fe^{3+} Complexes: Preparation and Antibacterial and Anticancer Activities (/2073-4360/14/22/5002)

Polymers **2022**, *14*(22), 5002; https://doi.org/10.3390/polym14225002 (https://doi.org/10.3390/polym14225002) - 18 Nov 2022

Open Access Article (/2073-4360/14/22/5001/pdf?version=1668763306)

Bacterial Cellulose Composites with Polysaccharides Filled with Nanosized Cerium Oxide: Characterization and Cytocompatibility Assessment (/2073-4360/14/22/5001)

Polymers **2022**, *14*(22), 5001; https://doi.org/10.3390/polym14225001 (https://doi.org/10.3390/polym14225001) - 18 Nov 2022

Open Access Article (/2073-4360/14/22/5000/pdf?version=1668762202)

Hybrid Polymer Composites Based on Polystyrene (PS) Used in the Melted and Extruded Manufacturing Technology (/2073-4360/14/22/5000)

Polymers **2022**, *14*(22), 5000; https://doi.org/10.3390/polym14225000 (https://doi.org/10.3390/polym14225000) - 18 Nov 2022

Open Access Article (/2073-4360/14/22/4999/pdf?version=1669091484)

Enhancing the Mechanical Properties of 3D-Printed Waterborne Polyurethane-Urea and Cellulose Nanocrystal Scaffolds through Crosslinking (/2073-4360/14/22/4999)

Polymers **2022**, *14*(22), 4999; https://doi.org/10.3390/polym14224999 (https://doi.org/10.3390/polym14224999) - 18 Nov 2022

Open Access Article (/2073-4360/14/22/4998/pdf?version=1668760173)

Comparative In Vitro Biocompatibility Study of the Two Orthodontic Bonding Materials of Different Types (/2073-4360/14/22/4998)

Polymers **2022**, *14*(22), 4998; https://doi.org/10.3390/polym14224998 (https://doi.org/10.3390/polym14224998) - 18 Nov 2022

Open Access Article (/2073-4360/14/22/4997/pdf?version=1668758652)

Progressive Methods in Studying the Charred Layer Parameters Change in Relation to Wood Moisture Content (/2073-4360/14/22/4997)

Polymers **2022**, *14*(22), 4997; https://doi.org/10.3390/polym14224997 (https://doi.org/10.3390/polym14224997) - 18 Nov 2022

Open Access Review (/2073-4360/14/22/4996/pdf?version=1669095985)

Critical Review on the Progress of Plastic Bioupcycling Technology as a Potential Solution for Sustainable Plastic Waste Management (/2073-4360/14/22/4996)

Polymers **2022**, *14*(22), 4996; https://doi.org/10.3390/polym14224996 (https://doi.org/10.3390/polym14224996) - 18 Nov 2022

Open Access Article (/2073-4360/14/22/4995/pdf?version=1668756314)

In Situ Ring-Opening Polymerization of *L*-lactide on the Surface of Pristine and Aminated Silica: Synthesis and Metal Ions Extraction (/2073-4360/14/22/4995)

Polymers **2022**, *14*(22), 4995; https://doi.org/10.3390/polym14224995 (https://doi.org/10.3390/polym14224995) - 18 Nov 2022

Open Access Article (/2073-4360/14/22/4994/pdf?version=1668754506)

Fabrication of an Eco-Friendly Clay-Based Coating for Enhancing Flame Retardant and Mechanical Properties of Cotton Fabrics via LbL Assembly (/2073-4360/14/22/4994)

Polymers **2022**, *14*(22), 4994; https://doi.org/10.3390/polym14224994 (https://doi.org/10.3390/polym14224994) - 18 Nov 2022

Open Access Article (/2073-4360/14/22/4993/pdf?version=1668760821)

Preparation, Characterization, and Anti-Adhesive Activity of Sulfate Polysaccharide from *Caulerpa lentillifera* against *Helicobacter pylori* (/2073-4360/14/22/4993)

Polymers **2022**, *14*(22), 4993; https://doi.org/10.3390/polym14224993 (https://doi.org/10.3390/polym14224993) - 18 Nov 2022

Open Access Review (/2073-4360/14/22/4992/pdf?version=1668747297)

Recent Advantages on Waste Management in Hydrogen Industry (/2073-4360/14/22/4992)

Polymers **2022**, *14*(22), 4992; https://doi.org/10.3390/polym14224992 (https://doi.org/10.3390/polym14224992) - 18 Nov 2022

Open Access Article (/2073-4360/14/22/4991/pdf?version=1668744529)

Synthesis of Cellulose Nanocrystals/HKUST-1 Composites and Their Applications: Crystal Violet Removal and Doxorubicin Loading (/2073-4360/14/22/4991)

Polymers **2022**, *14*(22), 4991; https://doi.org/10.3390/polym14224991 (https://doi.org/10.3390/polym14224991) - 18 Nov 2022

Open Access Article (/2073-4360/14/22/4990/pdf?version=1668741261)

Tensile Behavior of Joints of Strip Ends Made of Polymeric Materials (/2073-4360/14/22/4990)

Polymers **2022**, *14*(22), 4990; https://doi.org/10.3390/polym14224990 (https://doi.org/10.3390/polym14224990) - 18 Nov 2022

Open Access Article (/2073-4360/14/22/4989/pdf?version=1669084397)

Improving Mechanical, Electrical and Thermal Properties of Fluororubber by Constructing Interconnected Carbon Nanotube Networks with Chemical Bonds and F–H Polar Interactions (/2073-4360/14/22/4989)

Polymers **2022**, *14*(22), 4989; **https://doi.org/10.3390/polym14224989 (https://doi.org/10.3390/polym14224989)** - 17 Nov 2022

Open Access Article (/2073-4360/14/22/4988/pdf?version=1669088567)

Fused Filament Fabrication of Short Glass Fiber-Reinforced Polylactic Acid Composites: Infill Density Influence on Mechanical and Thermal Properties (/2073-4360/14/22/4988)

Polymers **2022**, *14*(22), 4988; **https://doi.org/10.3390/polym14224988 (https://doi.org/10.3390/polym14224988)** - 17 Nov 2022

Open Access Article (/2073-4360/14/22/4987/pdf?version=1669087677)

Assessment of Micro-Hardness, Degree of Conversion, and Flexural Strength for Single-Shade Universal Resin Composites (/2073-4360/14/22/4987)

Polymers **2022**, *14*(22), 4987; **https://doi.org/10.3390/polym14224987 (https://doi.org/10.3390/polym14224987)** - 17 Nov 2022

Open Access Article (/2073-4360/14/22/4986/pdf?version=1668751265)

Interpenetrating Low-Molecular Weight Hyaluronic Acid in Hyaluronic Acid-Based *In Situ* Hydrogel Scaffold for Periodontal and Oral Wound Applications (/2073-4360/14/22/4986)

Polymers **2022**, *14*(22), 4986; **https://doi.org/10.3390/polym14224986 (https://doi.org/10.3390/polym14224986)** - 17 Nov 2022

Open Access Article (/2073-4360/14/22/4985/pdf?version=1669090725)

A Multiaxial Fatigue Damage Model Based on Constant Life Diagrams for Polymer Fiber-Reinforced Laminates (/2073-4360/14/22/4985)

Polymers **2022**, *14*(22), 4985; **https://doi.org/10.3390/polym14224985 (https://doi.org/10.3390/polym14224985)** - 17 Nov 2022

Open Access Article (/2073-4360/14/22/4984/pdf?version=1669104405)

Strong, Tough, and Adhesive Polyampholyte/Natural Fiber Composite Hydrogels (/2073-4360/14/22/4984)

Polymers **2022**, *14*(22), 4984; **https://doi.org/10.3390/polym14224984 (https://doi.org/10.3390/polym14224984)** - 17 Nov 2022

Open Access Article (/2073-4360/14/22/4983/pdf?version=1669107860)

In Situ Synthesis of AZO-Np in Guar Gum/PVOH Composite Fiber Mats for Potential Bactericidal Release (/2073-4360/14/22/4983)

Polymers **2022**, *14*(22), 4983; **https://doi.org/10.3390/polym14224983 (https://doi.org/10.3390/polym14224983)** - 17 Nov 2022

Open Access Article (/2073-4360/14/22/4982/pdf?version=1668685677)

Color Stability of Zinc Oxide Poly(methyl methacrylate) Nanocomposite—A New Biomaterial for Denture Bases (/2073-4360/14/22/4982)

Polymers **2022**, *14*(22), 4982; **https://doi.org/10.3390/polym14224982 (https://doi.org/10.3390/polym14224982)** - 17 Nov 2022

Open Access Article (/2073-4360/14/22/4981/pdf?version=1668742359)

Scaling-Up an Aqueous Self-Degassing Electrochemically Mediated ATRP in Dispersion for the Preparation of Cellulose–Polymer Composites and Films (/2073-4360/14/22/4981)

Polymers **2022**, *14*(22), 4981; **https://doi.org/10.3390/polym14224981 (https://doi.org/10.3390/polym14224981)** - 17 Nov 2022

Open Access Article (/2073-4360/14/22/4980/pdf?version=1668737559)

Nonlinear Microscale Mechanics of Actin Networks Governed by Coupling of Filament Crosslinking and Stabilization (/2073-4360/14/22/4980)

Polymers **2022**, *14*(22), 4980; **https://doi.org/10.3390/polym14224980 (https://doi.org/10.3390/polym14224980)** - 17 Nov 2022

Open Access Article (/2073-4360/14/22/4979/pdf?version=1668678911)

Comparison of Dynamic Vibration Control Techniques by the GFRPU and/or LTMD System (/2073-4360/14/22/4979)

Polymers **2022**, *14*(22), 4979; **https://doi.org/10.3390/polym14224979 (https://doi.org/10.3390/polym14224979)** - 17 Nov 2022

Open Access Article (/2073-4360/14/22/4978/pdf?version=1669025451)

Triborheological Analysis of Reconstituted Gastrointestinal Mucus/Chitosan:TPP Nanoparticles System to Study Mucoadhesion Phenomenon under Different pH Conditions (/2073-4360/14/22/4978)

Polymers **2022**, *14*(22), 4978; **https://doi.org/10.3390/polym14224978 (https://doi.org/10.3390/polym14224978)** - 17 Nov 2022

Open Access Article (/2073-4360/14/22/4977/pdf?version=1668677363)

Carvedilol Precipitation Inhibition by the Incorporation of Polymeric Precipitation Inhibitors Using a Stable Amorphous Solid Dispersion Approach: Formulation, Characterization, and *In Vitro In Vivo* Evaluation (/2073-4360/14/22/4977)

Polymers **2022**, *14*(22), 4977; **https://doi.org/10.3390/polym14224977 (https://doi.org/10.3390/polym14224977)** - 17 Nov 2022

Open Access Article (/2073-4360/14/22/4976/pdf?version=1669087524)

Bacterial Response to the Surface Aging of PLA Matrices Loaded with Active Compounds (/2073-4360/14/22/4976)

Polymers **2022**, *14*(22), 4976; **https://doi.org/10.3390/polym14224976 (https://doi.org/10.3390/polym14224976)** - 17 Nov 2022

Open Access Article (/2073-4360/14/22/4975/pdf?version=1669096540)

Fast-Processable Non-Flammable Phthalonitrile-Modified Novolac/Carbon and Glass Fiber Composites (/2073-4360/14/22/4975)

Polymers **2022**, *14*(22), 4975; **https://doi.org/10.3390/polym14224975 (https://doi.org/10.3390/polym14224975)** - 17 Nov 2022

Open Access Article (/2073-4360/14/22/4974/pdf?version=1668670963)

Effect of Graphene Oxide and Reduced Graphene Oxide on the Properties of Sunflower Oil-Based Polyurethane Films (/2073-4360/14/22/4974)

Polymers **2022**, *14*(22), 4974; **https://doi.org/10.3390/polymm14224974 (https://doi.org/10.3390/polym14224974)** - 17 Nov 2022

MDPI (/)

Open Access Article **(/2073-4360/14/22/4973/pdf?version=1668736445)**

Synthesis of Biobased Hydroxyl-Terminated Oligomers by Metathesis Degradation of Industrial Rubbers SBS and PB: Tailor-Made Unsaturated Diols and Polyols (/2073-4360/14/22/4973)

(/toggle_desktop_layout_cookie)

Polymers **2022**, *14*(22), 4973; **https://doi.org/10.3390/polym14224973 (https://doi.org/10.3390/polym14224973)** - 17 Nov 2022

Open Access Editorial **(/2073-4360/14/22/4972/pdf?version=1668657233)**

Advances in Sustainable Polymeric Materials (/2073-4360/14/22/4972)

Polymers **2022**, *14*(22), 4972; **https://doi.org/10.3390/polym14224972 (https://doi.org/10.3390/polym14224972)** - 17 Nov 2022

Open Access Article **(/2073-4360/14/22/4971/pdf?version=1669026609)**

Investigation on Some Algal Extracts as Appropriate Stabilizers for Radiation-Processed Polymers (/2073-4360/14/22/4971)

Polymers **2022**, *14*(22), 4971; **https://doi.org/10.3390/polym14224971 (https://doi.org/10.3390/polym14224971)** - 16 Nov 2022

Open Access Article **(/2073-4360/14/22/4970/pdf?version=1668744495)**

Dynamic Behavior of Thermally Affected Injection-Molded High-Density Polyethylene Parts Modified by Accelerated Electrons (/2073-4360/14/22/4970)

Polymers **2022**, *14*(22), 4970; **https://doi.org/10.3390/polym14224970 (https://doi.org/10.3390/polym14224970)** - 16 Nov 2022

Open Access Article **(/2073-4360/14/22/4969/pdf?version=1668739682)**

Effects of Polyoxymethylene Fiber on Fresh and Hardened Properties of Seawater Sea-Sand Concrete (/2073-4360/14/22/4969)

Polymers **2022**, *14*(22), 4969; **https://doi.org/10.3390/polym14224969 (https://doi.org/10.3390/polym14224969)** - 16 Nov 2022

Open Access Review **(/2073-4360/14/22/4968/pdf?version=1668611010)**

Novel Features of Cellulose-Based Films as Sustainable Alternatives for Food Packaging (/2073-4360/14/22/4968)

Polymers **2022**, *14*(22), 4968; **https://doi.org/10.3390/polym14224968 (https://doi.org/10.3390/polym14224968)** - 16 Nov 2022

Open Access Article **(/2073-4360/14/22/4967/pdf?version=1669171518)**

Comprehensive Analysis of the Influence of Expanded Vermiculite on the Foaming Process and Selected Properties of Composite Rigid Polyurethane Foams (/2073-4360/14/22/4967)

Polymers **2022**, *14*(22), 4967; **https://doi.org/10.3390/polym14224967 (https://doi.org/10.3390/polym14224967)** - 16 Nov 2022

Open Access Article **(/2073-4360/14/22/4966/pdf?version=1669089656)**

A Dual-Cavity Fiber Fabry–Pérot Interferometer for Simultaneous Measurement of Thermo-Optic and Thermal Expansion Coefficients of a Polymer (/2073-4360/14/22/4966)

Polymers **2022**, *14*(22), 4966; **https://doi.org/10.3390/polym14224966 (https://doi.org/10.3390/polym14224966)** - 16 Nov 2022

Open Access Article **(/2073-4360/14/22/4965/pdf?version=1669083671)**

Conjugated Polymers Containing EDOT Units as Novel Materials for Electrochromic and Resistance Memory Devices (/2073-4360/14/22/4965)

Polymers **2022**, *14*(22), 4965; **https://doi.org/10.3390/polym14224965 (https://doi.org/10.3390/polym14224965)** - 16 Nov 2022

Open Access Article **(/2073-4360/14/22/4964/pdf?version=1669109312)**

Highlighting the Compositional Changes of the Sm_2O_3/MgO-Containing Cellulose Acetate Films for Wound Dressings (/2073-4360/14/22/4964)

Polymers **2022**, *14*(22), 4964; **https://doi.org/10.3390/polym14224964 (https://doi.org/10.3390/polym14224964)** - 16 Nov 2022

Open Access Article **(/2073-4360/14/22/4963/pdf?version=1669000191)**

Co-Culture of Halotolerant Bacteria to Produce Poly(3-hydroxybutyrate-co-3-hydroxyvalerate) Using Sewage Wastewater Substrate (/2073-4360/14/22/4963)

Polymers **2022**, *14*(22), 4963; **https://doi.org/10.3390/polym14224963 (https://doi.org/10.3390/polym14224963)** - 16 Nov 2022

Open Access Editor's Choice Article **(/2073-4360/14/22/4962/pdf?version=1669170970)**

Influence of Binder Composition and Material Extrusion (MEX) Parameters on the 3D Printing of Highly Filled Copper Feedstocks (/2073-4360/14/22/4962)

Polymers **2022**, *14*(22), 4962; **https://doi.org/10.3390/polym14224962 (https://doi.org/10.3390/polym14224962)** - 16 Nov 2022

Open Access Review **(/2073-4360/14/22/4961/pdf?version=1669022836)**

Nanoparticles for Biomedical Application and Their Synthesis (/2073-4360/14/22/4961)

Polymers **2022**, *14*(22), 4961; **https://doi.org/10.3390/polym14224961 (https://doi.org/10.3390/polym14224961)** - 16 Nov 2022

Open Access Article **(/2073-4360/14/22/4960/pdf?version=1668601144)**

Electromagnetic-Wave Absorption Properties of 3D-Printed Thermoplastic Polyurethane/Carbonyl Iron Powder Composites (/2073-4360/14/22/4960)

Polymers **2022**, *14*(22), 4960; **https://doi.org/10.3390/polym14224960 (https://doi.org/10.3390/polym14224960)** - 16 Nov 2022

Open Access Article **(/2073-4360/14/22/4959/pdf?version=1669271776)**

Environmentally Friendly Hybrid Organic–Inorganic Halogen-Free Coatings for Wood Fire-Retardant Applications (/2073-4360/14/22/4959)

Polymers **2022**, *14*(22), 4959; **https://doi.org/10.3390/polymers14224959 (https://doi.org/10.3390/polym14224959)** - 16 Nov 2022

Open Access Article **(/2073-4360/14/22/4958/pdf?version=1668595641)**

Numerical Simulation of Rheological Models for Complex Fluids Using Hierarchical Grids (/2073-4360/14/22/4958)

Polymers **2022**, *14*(22), 4958; **https://doi.org/10.3390/polym14224958 (https://doi.org/10.3390/polym14224958)** - 16 Nov 2022

Open Access Article **(/2073-4360/14/22/4957/pdf?version=1668597967)**

Effects of Heating Rate and Temperature on the Thermal Pyrolysis of Expanded Polystyrene Post-Industrial Waste (/2073-4360/14/22/4957)

Polymers **2022**, *14*(22), 4957; **https://doi.org/10.3390/polym14224957 (https://doi.org/10.3390/polym14224957)** - 16 Nov 2022

Open Access Article **(/2073-4360/14/22/4956/pdf?version=1668592479)**

Oscillating Laser Conduction Joining of Dissimilar PET to Stainless Steel (/2073-4360/14/22/4956)

Polymers **2022**, *14*(22), 4956; **https://doi.org/10.3390/polym14224956 (https://doi.org/10.3390/polym14224956)** - 16 Nov 2022

Open Access Article **(/2073-4360/14/22/4955/pdf?version=1669080142)**

Evaluation of Microscopic Damage of PEEK Polymers under Cyclic Loadings Using Molecular Dynamics Simulations (/2073-4360/14/22/4955)

Polymers **2022**, *14*(22), 4955; **https://doi.org/10.3390/polym14224955 (https://doi.org/10.3390/polym14224955)** - 16 Nov 2022

Open Access Review **(/2073-4360/14/22/4954/pdf?version=1668591062)**

From Classical to Advanced Use of Polymers in Food and Beverage Applications (/2073-4360/14/22/4954)

Polymers **2022**, *14*(22), 4954; **https://doi.org/10.3390/polym14224954 (https://doi.org/10.3390/polym14224954)** - 16 Nov 2022

Open Access Article **(/2073-4360/14/22/4953/pdf?version=1668645230)**

Electrochemically Enhanced Delivery of Pemetrexed from Electroactive Hydrogels (/2073-4360/14/22/4953)

Polymers **2022**, *14*(22), 4953; **https://doi.org/10.3390/polym14224953 (https://doi.org/10.3390/polym14224953)** - 16 Nov 2022

Open Access Article **(/2073-4360/14/22/4952/pdf?version=1668590993)**

Application of 3D-Woven Fabrics for Packaging Materials for Terminally Sterilized Medical Devices (/2073-4360/14/22/4952)

Polymers **2022**, *14*(22), 4952; **https://doi.org/10.3390/polym14224952 (https://doi.org/10.3390/polym14224952)** - 16 Nov 2022

Open Access Article **(/2073-4360/14/22/4951/pdf?version=1669001112)**

Construction and Adsorption Performance Study of GO-CNT/Activated Carbon Composites for High Efficient Adsorption of Pollutants in Wastewater (/2073-4360/14/22/4951)

Polymers **2022**, *14*(22), 4951; **https://doi.org/10.3390/polym14224951 (https://doi.org/10.3390/polym14224951)** - 16 Nov 2022

Open Access Article **(/2073-4360/14/22/4950/pdf?version=1668584779)**

Molecular Dynamics Studies of the Mechanical Behaviors and Thermal Conductivity of Polyisoprene with Different Degrees of Polymerization (/2073-4360/14/22/4950)

Polymers **2022**, *14*(22), 4950; **https://doi.org/10.3390/polym14224950 (https://doi.org/10.3390/polym14224950)** - 16 Nov 2022

Open Access Article **(/2073-4360/14/22/4949/pdf?version=1668582182)**

Fabrication of Flexible Wiring with Intrinsically Conducting Polymers Using Blue-Laser Microstereolithography (/2073-4360/14/22/4949)

Polymers **2022**, *14*(22), 4949; **https://doi.org/10.3390/polym14224949 (https://doi.org/10.3390/polym14224949)** - 16 Nov 2022

Open Access Article **(/2073-4360/14/22/4948/pdf?version=1669002038)**

Synthesis, Characterization, and Soil Burial Degradation of Biobased Polyurethanes (/2073-4360/14/22/4948)

Polymers **2022**, *14*(22), 4948; **https://doi.org/10.3390/polym14224948 (https://doi.org/10.3390/polym14224948)** - 16 Nov 2022

Open Access Article **(/2073-4360/14/22/4947/pdf?version=1669020956)**

The Applications of Ferulic-Acid-Loaded Fibrous Films for Fruit Preservation (/2073-4360/14/22/4947)

Polymers **2022**, *14*(22), 4947; **https://doi.org/10.3390/polym14224947 (https://doi.org/10.3390/polym14224947)** - 16 Nov 2022

Open Access Article **(/2073-4360/14/22/4946/pdf?version=1668587185)**

Exploring the Potential of Alternate Inorganic Fibers for Automotive Composites (/2073-4360/14/22/4946)

Polymers **2022**, *14*(22), 4946; **https://doi.org/10.3390/polym14224946 (https://doi.org/10.3390/polym14224946)** - 16 Nov 2022

Open Access Article **(/2073-4360/14/22/4945/pdf?version=1668577217)**

Influence of the Type of Binder Used in the Treatment of Cotton Fabric with Montmorillonite Particles on the Release of Negative Ions (/2073-4360/14/22/4945)

Polymers **2022**, *14*(22), 4945; **https://doi.org/10.3390/polym14224945 (https://doi.org/10.3390/polym14224945)** - 16 Nov 2022

Open Access Article **(/2073-4360/14/22/4944/pdf?version=1668573579)**

The Functionalization of a Honeycomb Polystyrene Pattern by Excimer Treatment in Liquid (/2073-4360/14/22/4944)

Polymers **2022**, *14*(22), 4944; **https://doi.org/10.3390/polym14224944 (https://doi.org/10.3390/polym14224944)** - 16 Nov 2022

Open Access Article (/2073-4360/14/22/4943/pdf?version=1669032152)

MDPI (/)

Layer-by-Layer Surface Modification of Alendronate-Loaded Polyester Microparticles—Enabling Protein Immobilization (/2073-4360/14/22/4943)

Polymers **2022**, *14*(22), 4943; https://doi.org/10.3390/polym14224943 (https://doi.org/10.3390/polym14224943) - 15 Nov 2022 (/toggle_desktop_layout_cookie)

Open Access Article (/2073-4360/14/22/4942/pdf?version=1669029516)

Hollow TiO_2/Poly (Vinyl Pyrrolidone) Fibers Obtained via Coaxial Electrospinning as Easy-to-Handle Photocatalysts for Effective Nitrogen Oxide Removal (/2073-4360/14/22/4942)

Polymers **2022**, *14*(22), 4942; https://doi.org/10.3390/polym14224942 (https://doi.org/10.3390/polym14224942) - 15 Nov 2022

Open Access Review (/2073-4360/14/22/4941/pdf?version=1669171711)

A Review on Microstructural Formations of Discontinuous Fiber-Reinforced Polymer Composites Prepared via Material Extrusion Additive Manufacturing: Fiber Orientation, Fiber Attrition, and Micro-Voids Distribution (/2073-4360/14/22/4941)

Polymers **2022**, *14*(22), 4941; https://doi.org/10.3390/polym14224941 (https://doi.org/10.3390/polym14224941) - 15 Nov 2022

Open Access Article (/2073-4360/14/22/4940/pdf?version=1668522581)

Mechanical Performance of Recycled Reinforced Polyamide from Rejected Railway Fastenings Flanged Plates (/2073-4360/14/22/4940)

Polymers **2022**, *14*(22), 4940; https://doi.org/10.3390/polym14224940 (https://doi.org/10.3390/polym14224940) - 15 Nov 2022

Open Access Article (/2073-4360/14/22/4939/pdf?version=1669045264)

Research on the Structure Design and Mechanical Properties of Performance Optimized Multi-Axial Geogrid (/2073-4360/14/22/4939)

Polymers **2022**, *14*(22), 4939; https://doi.org/10.3390/polym14224939 (https://doi.org/10.3390/polym14224939) - 15 Nov 2022

Open Access Article (/2073-4360/14/22/4938/pdf?version=1668515979)

Polyurethane Foam Waste Upcycling into an Efficient and Low Pollutant Gasification Syngas (/2073-4360/14/22/4938)

Polymers **2022**, *14*(22), 4938; https://doi.org/10.3390/polym14224938 (https://doi.org/10.3390/polym14224938) - 15 Nov 2022

Open Access Article (/2073-4360/14/22/4937/pdf?version=1669023365)

Phosphine-Functionalized Core-Crosslinked Micelles and Nanogels with an Anionic Poly(styrenesulfonate) Shell: Synthesis, Rhodium(I) Coordination and Aqueous Biphasic Hydrogenation Catalysis (/2073-4360/14/22/4937)

Polymers **2022**, *14*(22), 4937; https://doi.org/10.3390/polym14224937 (https://doi.org/10.3390/polym14224937) - 15 Nov 2022

Open Access Article (/2073-4360/14/22/4936/pdf?version=1668509219)

Porphyrin Polymers Bearing *N*,*N′*-Ethylene Crosslinkers as Photosensitizers against Bacteria (/2073-4360/14/22/4936)

Polymers **2022**, *14*(22), 4936; https://doi.org/10.3390/polym14224936 (https://doi.org/10.3390/polym14224936) - 15 Nov 2022

Open Access Article (/2073-4360/14/22/4935/pdf?version=1668522007)

A Study on Hot Stamping Formability of Continuous Glass Fiber Reinforced Thermoplastic Composites (/2073-4360/14/22/4935)

Polymers **2022**, *14*(22), 4935; https://doi.org/10.3390/polym14224935 (https://doi.org/10.3390/polym14224935) - 15 Nov 2022

Open Access Article (/2073-4360/14/22/4934/pdf?version=1668508234)

Restrained Shrinkage of High-Performance Ready-Mix Concrete Reinforced with Low Volume Fraction of Hybrid Fibers (/2073-4360/14/22/4934)

Polymers **2022**, *14*(22), 4934; https://doi.org/10.3390/polym14224934 (https://doi.org/10.3390/polym14224934) - 15 Nov 2022

Open Access Article (/2073-4360/14/22/4933/pdf?version=1668508549)

Binary Polyamide-Imide Fibrous Superelastic Aerogels for Fire-Retardant and High-Temperature Air Filtration (/2073-4360/14/22/4933)

Polymers **2022**, *14*(22), 4933; https://doi.org/10.3390/polym14224933 (https://doi.org/10.3390/polym14224933) - 15 Nov 2022

Open Access Article (/2073-4360/14/22/4932/pdf?version=1668508270)

Improvement in Injection Molding Quality Performance with Innovative Cyclone Mixers Used in Polypropylene with Spherical Silicon Dioxide Composites (/2073-4360/14/22/4932)

Polymers **2022**, *14*(22), 4932; https://doi.org/10.3390/polym14224932 (https://doi.org/10.3390/polym14224932) - 15 Nov 2022

Open Access Review (/2073-4360/14/22/4931/pdf?version=1668506849)

Silk Sericin: A Promising Sustainable Biomaterial for Biomedical and Pharmaceutical Applications (/2073-4360/14/22/4931)

Polymers **2022**, *14*(22), 4931; https://doi.org/10.3390/polym14224931 (https://doi.org/10.3390/polym14224931) - 15 Nov 2022

Open Access Article (/2073-4360/14/22/4930/pdf?version=1668505319)

Effect of Infill Density in FDM 3D Printing on Low-Cycle Stress of Bamboo-Filled PLA-Based Material (/2073-4360/14/22/4930)

Polymers **2022**, *14*(22), 4930; https://doi.org/10.3390/polym14224930 (https://doi.org/10.3390/polym14224930) - 15 Nov 2022

Open Access Article (/2073-4360/14/22/4929/pdf?version=1669108511)

Thermal Degradation of Organophosphorus Flame Retardants (/2073-4360/14/22/4929)

Polymers **2022**, *14*(22), 4929; https://doi.org/10.3390/polym14224929 (https://doi.org/10.3390/polym14224929) - 15 Nov 2022

Open Access Feature Paper Review (/2073-4360/14/22/4928/pdf?version=1668504296)

Methods of Analyses for Biodegradable Polymers: A Review (/2073-4360/14/22/4928)

Polymers **2022**, *14*(22), 4928; **https://doi.org/10.3390/polym14224928 (https://doi.org/10.3390/polym14224928)** - 15 Nov 2022

Open Access Article (/2073-4360/14/22/4927/pdf?version=1668503436) (/toggle_desktop_layout_cookie)

Improving the Thermal Stability and Flame Retardancy of Epoxy Resins by Lamellar Cobalt Potassium Pyrophosphate (/2073-4360/14/22/4927)

Polymers **2022**, *14*(22), 4927; **https://doi.org/10.3390/polym14224927 (https://doi.org/10.3390/polym14224927)** - 15 Nov 2022

Open Access Article (/2073-4360/14/22/4926/pdf?version=1668567361)

Determination of the Long-Term Thermal Performance of Foam Insulation Materials through Heat and Slicing Acceleration (/2073-4360/14/22/4926)

Polymers **2022**, *14*(22), 4926; **https://doi.org/10.3390/polym14224926 (https://doi.org/10.3390/polym14224926)** - 15 Nov 2022

Open Access Article (/2073-4360/14/22/4925/pdf?version=1668498974)

Structural Analysis of Carbon Fiber 3D-Printed Ribs for Small Wind Turbine Blades (/2073-4360/14/22/4925)

Polymers **2022**, *14*(22), 4925; **https://doi.org/10.3390/polym14224925 (https://doi.org/10.3390/polym14224925)** - 15 Nov 2022

Open Access Review (/2073-4360/14/22/4924/pdf?version=1668498793)

Recent Advances in Biodegradable Polymers and Their Biological Applications: A Brief Review (/2073-4360/14/22/4924)

Polymers **2022**, *14*(22), 4924; **https://doi.org/10.3390/polym14224924 (https://doi.org/10.3390/polym14224924)** - 15 Nov 2022

Open Access Article (/2073-4360/14/22/4923/pdf?version=1668498270)

Self-Assembled Supramolecular Micelles Based on Multiple Hydrogen Bonding Motifs for the Encapsulation and Release of Fullerene (/2073-4360/14/22/4923)

Polymers **2022**, *14*(22), 4923; **https://doi.org/10.3390/polym14224923 (https://doi.org/10.3390/polym14224923)** - 15 Nov 2022

Open Access Article (/2073-4360/14/22/4922/pdf?version=1668493611)

Surface Modification of Electrospun Bioresorbable and Biostable Scaffolds by Pulsed DC Magnetron Sputtering of Titanium for Gingival Tissue Regeneration (/2073-4360/14/22/4922)

Polymers **2022**, *14*(22), 4922; **https://doi.org/10.3390/polym14224922 (https://doi.org/10.3390/polym14224922)** - 15 Nov 2022

Open Access Article (/2073-4360/14/22/4921/pdf?version=1668490727)

Synthetic Heparan Sulfate Mimetic Polymer Enhances Corneal Nerve Regeneration and Wound Healing after Experimental Laser Ablation Injury in Mice (/2073-4360/14/22/4921)

Polymers **2022**, *14*(22), 4921; **https://doi.org/10.3390/polym14224921 (https://doi.org/10.3390/polym14224921)** - 15 Nov 2022

Open Access Article (/2073-4360/14/22/4920/pdf?version=1668484005)

Physically and Chemically Stable Anion Exchange Membranes with Hydrogen-Bond Induced Ion Conducting Channels (/2073-4360/14/22/4920)

Polymers **2022**, *14*(22), 4920; **https://doi.org/10.3390/polym14224920 (https://doi.org/10.3390/polym14224920)** - 15 Nov 2022

Open Access Article (/2073-4360/14/22/4919/pdf?version=1669006135)

Self-Healing and Reprocessable Oleic Acid-Based Elastomer with Dynamic S-S Bonds as Solvent-Free Reusable Adhesive on Copper Surface (/2073-4360/14/22/4919)

Polymers **2022**, *14*(22), 4919; **https://doi.org/10.3390/polym14224919 (https://doi.org/10.3390/polym14224919)** - 14 Nov 2022

Open Access Article (/2073-4360/14/22/4918/pdf?version=1668583394)

Mechanism Analysis of Ethanol Production from Cellulosic Insulating Paper Based on Reaction Molecular Dynamics (/2073-4360/14/22/4918)

Polymers **2022**, *14*(22), 4918; **https://doi.org/10.3390/polym14224918 (https://doi.org/10.3390/polym14224918)** - 14 Nov 2022

Open Access Article (/2073-4360/14/22/4917/pdf?version=1668753839)

Development of an Atmospheric Pressure Plasma Jet Device Using Four-Bore Tubing and Its Applications of In-Liquid Material Decomposition and Solution Plasma Polymerization (/2073-4360/14/22/4917)

Polymers **2022**, *14*(22), 4917; **https://doi.org/10.3390/polym14224917 (https://doi.org/10.3390/polym14224917)** - 14 Nov 2022

Open Access Article (/2073-4360/14/22/4916/pdf?version=1668487439)

Mechanical Response of Fiber-Filled Automotive Body Panels Manufactured with the Ku-Fizz™ Microcellular Injection Molding Process (/2073-4360/14/22/4916)

Polymers **2022**, *14*(22), 4916; **https://doi.org/10.3390/polym14224916 (https://doi.org/10.3390/polym14224916)** - 14 Nov 2022

Open Access Feature Paper Article (/2073-4360/14/22/4915/pdf?version=1668428861)

Biological Effects and Toxicity of Compounds Based on Cured Epoxy Resins (/2073-4360/14/22/4915)

Polymers **2022**, *14*(22), 4915; **https://doi.org/10.3390/polym14224915 (https://doi.org/10.3390/polym14224915)** - 14 Nov 2022

Open Access Article (/2073-4360/14/22/4914/pdf?version=1669003851)

Fabrication and Characterization of Intelligent Multi-Layered Biopolymer Film Incorporated with pH-Sensitive Red Cabbage Extract to Indicate Fish Freshness (/2073-4360/14/22/4914)

Polymers **2022**, *14*(22), 4914; **https://doi.org/10.3390/polym14224914 (https://doi.org/10.3390/polym14224914)** - 14 Nov 2022

Open Access Article (/2073-4360/14/22/4913/pdf?version=1668426109)

[Combined Magnetic Hyperthermia and Photothermia with Polyelectrolyte/Gold-Coated Magnetic Nanorods (/2073-4360/14/22/4913)]

Polymers **2022**, *14*(22), 4913; https://doi.org/10.3390/polym14224913 (https://doi.org/10.3390/polym14224913) - 14 Nov 2022

Open Access Article (/2073-4360/14/22/4912/pdf?version=1668426219)

Influence of Molecular Weight and Grafting Density of PEG on the Surface Properties of Polyurethanes and Their Effect on the Viability and Morphology of Fibroblasts and Osteoblasts (/2073-4360/14/22/4912)

Polymers **2022**, *14*(22), 4912; https://doi.org/10.3390/polym14224912 (https://doi.org/10.3390/polym14224912) - 14 Nov 2022

Open Access Feature Paper Article (/2073-4360/14/22/4911/pdf?version=1668699384)

One-Pot Terpolymerization of Macrolactones with Limonene Oxide and Phtalic Anhydride to Produce di-Block Semi-Aromatic Polyesters (/2073-4360/14/22/4911)

Polymers **2022**, *14*(22), 4911; https://doi.org/10.3390/polym14224911 (https://doi.org/10.3390/polym14224911) - 14 Nov 2022

Open Access Article (/2073-4360/14/22/4910/pdf?version=1668420542)

Experimental Measurement of Diffusion Coefficient of Polyimide Film for Capacitive Humidity Sensors (/2073-4360/14/22/4910)

Polymers **2022**, *14*(22), 4910; https://doi.org/10.3390/polym14224910 (https://doi.org/10.3390/polym14224910) - 14 Nov 2022

Open Access Article (/2073-4360/14/22/4909/pdf?version=1668416182)

Simultaneous Adsorption of Cu^{2+} and Cd^{2+} by a Simple Synthesis of Environmentally Friendly Bamboo Pulp Aerogels: Adsorption Properties and Mechanisms (/2073-4360/14/22/4909)

Polymers **2022**, *14*(22), 4909; https://doi.org/10.3390/polym14224909 (https://doi.org/10.3390/polym14224909) - 14 Nov 2022

Open Access Article (/2073-4360/14/22/4908/pdf?version=1668419796)

Post-Treatment of Tannic Acid for Thermally Stable PEDOT:PSS Film (/2073-4360/14/22/4908)

Polymers **2022**, *14*(22), 4908; https://doi.org/10.3390/polym14224908 (https://doi.org/10.3390/polym14224908) - 14 Nov 2022

Open Access Article (/2073-4360/14/22/4907/pdf?version=1668412269)

Lung Extracellular Matrix Hydrogels-Derived Vesicles Contribute to Epithelial Lung Repair (/2073-4360/14/22/4907)

Polymers **2022**, *14*(22), 4907; https://doi.org/10.3390/polym14224907 (https://doi.org/10.3390/polym14224907) - 14 Nov 2022

Open Access Review (/2073-4360/14/22/4906/pdf?version=1668512056)

Application of Hydrogels as Sustained-Release Drug Carriers in Bone Defect Repair (/2073-4360/14/22/4906)

Polymers **2022**, *14*(22), 4906; https://doi.org/10.3390/polym14224906 (https://doi.org/10.3390/polym14224906) - 14 Nov 2022

Open Access Article (/2073-4360/14/22/4905/pdf?version=1668407837)

Irinotecan-Loaded Polymeric Micelles as a Promising Alternative to Enhance Antitumor Efficacy in Colorectal Cancer Therapy (/2073-4360/14/22/4905)

Polymers **2022**, *14*(22), 4905; https://doi.org/10.3390/polym14224905 (https://doi.org/10.3390/polym14224905) - 14 Nov 2022

Open Access Article (/2073-4360/14/22/4904/pdf?version=1668407215)

Understanding the Flame Retardant Mechanism of Intumescent Flame Retardant on Improving the Fire Safety of Rigid Polyurethane Foam (/2073-4360/14/22/4904)

Polymers **2022**, *14*(22), 4904; https://doi.org/10.3390/polym14224904 (https://doi.org/10.3390/polym14224904) - 14 Nov 2022

Open Access Article (/2073-4360/14/22/4903/pdf?version=1668345929)

Mechanically Robust and Flexible GO/PI Hybrid Aerogels as Highly Efficient Oil Absorbents (/2073-4360/14/22/4903)

Polymers **2022**, *14*(22), 4903; https://doi.org/10.3390/polym14224903 (https://doi.org/10.3390/polym14224903) - 13 Nov 2022

Open Access Article (/2073-4360/14/22/4902/pdf?version=1669026737)

Polymorphic Crystallization Behavior of a Poly(butylene adipate) Midblock within a Poly(L-lactide-butylene adipate-L-lactide) Triblock Copolymer (/2073-4360/14/22/4902)

Polymers **2022**, *14*(22), 4902; https://doi.org/10.3390/polym14224902 (https://doi.org/10.3390/polym14224902) - 13 Nov 2022

Open Access Article (/2073-4360/14/22/4901/pdf?version=1668338534)

Amphiphilic Copolymer-Lipid Chimeric Nanosystems as DNA Vectors (/2073-4360/14/22/4901)

Polymers **2022**, *14*(22), 4901; https://doi.org/10.3390/polym14224901 (https://doi.org/10.3390/polym14224901) - 13 Nov 2022

Open Access Article (/2073-4360/14/22/4900/pdf?version=1668336669)

Graft Polymerization of Acrylamide in an Aqueous Dispersion of Collagen in the Presence of Tributylborane (/2073-4360/14/22/4900)

Polymers **2022**, *14*(22), 4900; https://doi.org/10.3390/polym14224900 (https://doi.org/10.3390/polym14224900) - 13 Nov 2022

Open Access Article (/2073-4360/14/22/4899/pdf?version=1668395984)

Highly Durable Antibacterial Properties of Cellulosic Fabric via β-Cyclodextrin/Essential Oils Inclusion Complex (/2073-4360/14/22/4899)

Polymers **2022**, *14*(22), 4899; https://doi.org/10.3390/polym14224899 (https://doi.org/10.3390/polym14224899) - 13 Nov 2022

Open Access Review

MDPI (/)

[Optical Filters Based on Cholesteric, Blue and Sphere Mesophases (/2073-4360/14/22/4898)](/2073-4360/14/22/4898/pdf?version=1668335906)

Polymers **2022**, *14*(22), 4898; https://doi.org/10.3390/polym14224898 (https://doi.org/10.3390/polym14224898) - 13 Nov 2022

(/toggle_desktop_layout_cookie)

Open Access Article (/2073-4360/14/22/4897/pdf?version=1668334316)

pH-Driven Selective Adsorption of Multi-Dyes Solutions by Loofah Sponge and Polyaniline-Modified Loofah Sponge (/2073-4360/14/22/4897)

Polymers **2022**, *14*(22), 4897; https://doi.org/10.3390/polym14224897 (https://doi.org/10.3390/polym14224897) - 13 Nov 2022

Open Access Article (/2073-4360/14/22/4896/pdf?version=1668334618)

Sustainable Recycling of Waste from Nitrile Gloves: Prolonging the Life Span by Designing Proper Curing Systems (/2073-4360/14/22/4896)

Polymers **2022**, *14*(22), 4896; https://doi.org/10.3390/polym14224896 (https://doi.org/10.3390/polym14224896) - 13 Nov 2022

Open Access Article (/2073-4360/14/22/4895/pdf?version=1668760812)

Synthesis of Biodegradable Polyester–Polyether with Enhanced Hydrophilicity, Thermal Stability, Toughness, and Degradation Rate (/2073-4360/14/22/4895)

Polymers **2022**, *14*(22), 4895; https://doi.org/10.3390/polym14224895 (https://doi.org/10.3390/polym14224895) - 13 Nov 2022

Open Access Article (/2073-4360/14/22/4894/pdf?version=1668329480)

Study on SBS Optimal Block Ratio Based on Molecular Simulation (/2073-4360/14/22/4894)

Polymers **2022**, *14*(22), 4894; https://doi.org/10.3390/polym14224894 (https://doi.org/10.3390/polym14224894) - 13 Nov 2022

Open Access Article (/2073-4360/14/22/4893/pdf?version=1668404344)

Zn (II) Porphyrin Built-in D–A Covalent Organic Framework for Efficient Photocatalytic H_2 Evolution (/2073-4360/14/22/4893)

Polymers **2022**, *14*(22), 4893; https://doi.org/10.3390/polym14224893 (https://doi.org/10.3390/polym14224893) - 13 Nov 2022

Open Access Article (/2073-4360/14/22/4892/pdf?version=1669017448)

Effects of Air Plasma Modification on Aramid Fiber Surface and Its Composite Interface and Mechanical Properties (/2073-4360/14/22/4892)

Polymers **2022**, *14*(22), 4892; https://doi.org/10.3390/polym14224892 (https://doi.org/10.3390/polym14224892) - 13 Nov 2022

Open Access Article (/2073-4360/14/22/4891/pdf?version=1668680202)

Multiaxial Deformations of Elastomeric Skins for Morphing Wing Applications: Theoretical Modeling and Experimental Investigations (/2073-4360/14/22/4891)

Polymers **2022**, *14*(22), 4891; https://doi.org/10.3390/polym14224891 (https://doi.org/10.3390/polym14224891) - 12 Nov 2022

Open Access Article (/2073-4360/14/22/4890/pdf?version=1668253550)

Effective Tensile Strength Estimation of Natural Fibers through Micromechanical Models: The Case of Henequen Fiber Reinforced-PP Composites (/2073-4360/14/22/4890)

Polymers **2022**, *14*(22), 4890; https://doi.org/10.3390/polym14224890 (https://doi.org/10.3390/polym14224890) - 12 Nov 2022

Open Access Article (/2073-4360/14/22/4889/pdf?version=1668248336)

Effect of Ultraviolet—A Radiation on Alicyclic Epoxy Resin and Silicone Rubber Used for Insulators (/2073-4360/14/22/4889)

Polymers **2022**, *14*(22), 4889; https://doi.org/10.3390/polym14224889 (https://doi.org/10.3390/polym14224889) - 12 Nov 2022

Open Access Article (/2073-4360/14/22/4888/pdf?version=1668412242)

Preparation and Application of a Magnetic Oxidized Micro/Mesoporous Carbon with Efficient Adsorption for Cu(II) and Pb(II) (/2073-4360/14/22/4888)

Polymers **2022**, *14*(22), 4888; https://doi.org/10.3390/polym14224888 (https://doi.org/10.3390/polym14224888) - 12 Nov 2022

Open Access Article (/2073-4360/14/22/4887/pdf?version=1668247461)

Experimental Investigation of Bi-Directional Flax with Ramie Fibre-Reinforced Phenol-Formaldehyde Hybrid Composites (/2073-4360/14/22/4887)

Polymers **2022**, *14*(22), 4887; https://doi.org/10.3390/polym14224887 (https://doi.org/10.3390/polym14224887) - 12 Nov 2022

Open Access Article (/2073-4360/14/22/4886/pdf?version=1668388942)

Effective and Easy Techniques of Collagen Deposition onto Polylactide Films: DC-Discharge Plasma Treatment vs. Chemical Entrapment (/2073-4360/14/22/4886)

Polymers **2022**, *14*(22), 4886; https://doi.org/10.3390/polym14224886 (https://doi.org/10.3390/polym14224886) - 12 Nov 2022

Open Access Article (/2073-4360/14/22/4885/pdf?version=1669263339)

Thermal Stability, Flammability and Mechanical Performances of Unsaturated Polyester–Melamine Resin Blends and of Glass Fibre-Reinforced Composites Based on Them (/2073-4360/14/22/4885)

Polymers **2022**, *14*(22), 4885; https://doi.org/10.3390/polym14224885 (https://doi.org/10.3390/polym14224885) - 12 Nov 2022

Open Access Article (/2073-4360/14/22/4884/pdf?version=1668744551)

Development and Characterization of Biocomposite Films Based on Polysaccharides Derived from Okra Plant Waste for Food Packaging Application (/2073-4360/14/22/4884)

Polymers **2022**, *14*(22), 4884; https://doi.org/10.3390/polym14224884 (https://doi.org/10.3390/polym14224884) - 12 Nov 2022

Open Access Article (/2073-4360/14/22/4883/pdf?version=1668244571)

[Preparation of Mannitol-Modified Loofah and Its High-Efficient Adsorption of Cu(II) Ions in Aqueous Solution (/2073-4360/14/22/4883)](/2073-4360/14/22/4883)

Polymers **2022**, *14*(22), 4883; https://doi.org/10.3390/polym14224883 (https://doi.org/10.3390/polym14224883) - 12 Nov 2022

Open Access Article (/2073-4360/14/22/4882/pdf?version=1669716621)

Physico-Mechanical, Thermal, Morphological, and Aging Characteristics of Green Hybrid Composites Prepared from Wool-Sisal and Wool-Palf with Natural Rubber (/2073-4360/14/22/4882)

Polymers **2022**, *14*(22), 4882; https://doi.org/10.3390/polym14224882 (https://doi.org/10.3390/polym14224882) - 12 Nov 2022

Open Access Article (/2073-4360/14/22/4881/pdf?version=1668750581)

Active and pH-Sensitive Nanopackaging Based on Polymeric Anthocyanin/Natural or Organo-Modified Montmorillonite Blends: Characterization and Assessment of Cytotoxicity (/2073-4360/14/22/4881)

Polymers **2022**, *14*(22), 4881; https://doi.org/10.3390/polym14224881 (https://doi.org/10.3390/polym14224881) - 12 Nov 2022

Open Access Article (/2073-4360/14/22/4880/pdf?version=1668243720)

The Development of New Nanocomposite Polytetrafluoroethylene/Fe_2O_3 NPs to Prevent Bacterial Contamination in Meat Industry (/2073-4360/14/22/4880)

Polymers **2022**, *14*(22), 4880; https://doi.org/10.3390/polym14224880 (https://doi.org/10.3390/polym14224880) - 12 Nov 2022

Open Access Article (/2073-4360/14/22/4879/pdf?version=1669012703)

A Metal Coordination-Based Supramolecular Elastomer with Shape Memory-Assisted Self-Healing Effect (/2073-4360/14/22/4879)

Polymers **2022**, *14*(22), 4879; https://doi.org/10.3390/polym14224879 (https://doi.org/10.3390/polym14224879) - 12 Nov 2022

Open Access Article (/2073-4360/14/22/4878/pdf?version=1668242813)

Bioinspired Electropun Fibrous Materials Based on Poly-3-Hydroxybutyrate and Hemin: Preparation, Physicochemical Properties, and Weathering (/2073-4360/14/22/4878)

Polymers **2022**, *14*(22), 4878; https://doi.org/10.3390/polym14224878 (https://doi.org/10.3390/polym14224878) - 12 Nov 2022

Open Access Article (/2073-4360/14/22/4877/pdf?version=1669099261)

Influence of Fiber Content and Dosing Position on the the Mechanical Properties of Short-Carbon-Fiber Polypropylene Compounds (/2073-4360/14/22/4877)

Polymers **2022**, *14*(22), 4877; https://doi.org/10.3390/polym14224877 (https://doi.org/10.3390/polym14224877) - 12 Nov 2022

Open Access Article (/2073-4360/14/22/4876/pdf?version=1668563150)

Relaxation and Amorphous Structure of Polymers Containing Rigid Fumarate Segments (/2073-4360/14/22/4876)

Polymers **2022**, *14*(22), 4876; https://doi.org/10.3390/polym14224876 (https://doi.org/10.3390/polym14224876) - 12 Nov 2022

Open Access Review (/2073-4360/14/22/4875/pdf?version=1668240236)

A Comprehensive Study on Starch Nanoparticle Potential as a Reinforcing Material in Bioplastic (/2073-4360/14/22/4875)

Polymers **2022**, *14*(22), 4875; https://doi.org/10.3390/polym14224875 (https://doi.org/10.3390/polym14224875) - 12 Nov 2022

Open Access Review (/2073-4360/14/22/4874/pdf?version=1668236490)

A Review on the Effect of the Mechanism of Organic Polymers on Pellet Properties for Iron Ore Beneficiation (/2073-4360/14/22/4874)

Polymers **2022**, *14*(22), 4874; https://doi.org/10.3390/polym14224874 (https://doi.org/10.3390/polym14224874) - 12 Nov 2022

Open Access Article (/2073-4360/14/22/4873/pdf?version=1668567635)

On the Resin Transfer Molding (RTM) Infiltration of Fiber-Reinforced Composites Made by Tailored Fiber Placement (/2073-4360/14/22/4873)

Polymers **2022**, *14*(22), 4873; https://doi.org/10.3390/polym14224873 (https://doi.org/10.3390/polym14224873) - 12 Nov 2022

Open Access Article (/2073-4360/14/22/4872/pdf?version=1668760514)

Evolution of Shore Hardness under Uniaxial Tension/Compression in Body-Temperature Programmable Elastic Shape Memory Hybrids (/2073-4360/14/22/4872)

Polymers **2022**, *14*(22), 4872; https://doi.org/10.3390/polym14224872 (https://doi.org/10.3390/polym14224872) - 11 Nov 2022

Open Access Article (/2073-4360/14/22/4871/pdf?version=1668185035)

Phosphorylated Metal–Organic Framework for Reducing Fire Hazards of Poly(Methyl Methacrylate) (/2073-4360/14/22/4871)

Polymers **2022**, *14*(22), 4871; https://doi.org/10.3390/polym14224871 (https://doi.org/10.3390/polym14224871) - 11 Nov 2022

Open Access Article (/2073-4360/14/22/4870/pdf?version=1668755605)

Temperature Effects on Effluent Microgel Formation (/2073-4360/14/22/4870)

Polymers **2022**, *14*(22), 4870; https://doi.org/10.3390/polym14224870 (https://doi.org/10.3390/polym14224870) - 11 Nov 2022

Open Access Article (/2073-4360/14/22/4869/pdf?version=1668848640)

Polyurethane Recycling: Conversion of Carbamates—Catalysis, Side-Reactions and Mole Balance (/2073-4360/14/22/4869)

Polymers **2022**, *14*(22), 4869; https://doi.org/10.3390/polym14224869 (https://doi.org/10.3390/polym14224869) - 11 Nov 2022

Open Access Article (/2073-4360/14/22/4868/pdf?version=1668165766)

Physical, Chemical, and Mechanical Properties of Six Bamboo from Sumatera Island Indonesia and Its Potential Applications for Composite Materials (/2073-4360/14/22/4868)

Polymers **2022**, *14*(22), 4868; https://doi.org/10.3390/polym14224868 (https://doi.org/10.3390/polym14224868) - 11 Nov 2022

Open Access Communication (/2073-4360/14/22/4867/pdf?version=1668164551)

Reusable Macroporous Oil Sorbent Films from Plastic Wastes (/2073-4360/14/22/4867)

Polymers **2022**, *14*(22), 4867; https://doi.org/10.3390/polym14224867 (https://doi.org/10.3390/polym14224867) - 11 Nov 2022

Open Access Article (/2073-4360/14/22/4866/pdf?version=1668164923)

Ballistic Limit of UHMWPE Composite Armor under Impact of Ogive-Nose Projectile (/2073-4360/14/22/4866)

Polymers **2022**, *14*(22), 4866; https://doi.org/10.3390/polym14224866 (https://doi.org/10.3390/polym14224866) - 11 Nov 2022

Open Access Article (/2073-4360/14/22/4865/pdf?version=1668165159)

Supported Imidazolium-Based Ionic Liquids on a Polysulfone Matrix for Enhanced CO_2 Capture (/2073-4360/14/22/4865)

Polymers **2022**, *14*(22), 4865; https://doi.org/10.3390/polym14224865 (https://doi.org/10.3390/polym14224865) - 11 Nov 2022

Open Access Review (/2073-4360/14/22/4864/pdf?version=1668666264)

Pineapple Agro-Industrial Biomass to Produce Biomedical Applications in a Circular Economy Context in Costa Rica (/2073-4360/14/22/4864)

Polymers **2022**, *14*(22), 4864; https://doi.org/10.3390/polym14224864 (https://doi.org/10.3390/polym14224864) - 11 Nov 2022

Open Access Article (/2073-4360/14/22/4863/pdf?version=1668560233)

Analyzing the Mechanical Properties of Free-Standing PACA Thin Films Using Microindentation Technique (/2073-4360/14/22/4863)

Polymers **2022**, *14*(22), 4863; https://doi.org/10.3390/polym14224863 (https://doi.org/10.3390/polym14224863) - 11 Nov 2022

Open Access Article (/2073-4360/14/22/4862/pdf?version=1668162285)

Synthesis and Biocompatibility Evaluation of PCL Electrospun Membranes Coated with MTA/HA for Potential Application in Dental Pulp Capping (/2073-4360/14/22/4862)

Polymers **2022**, *14*(22), 4862; https://doi.org/10.3390/polym14224862 (https://doi.org/10.3390/polym14224862) - 11 Nov 2022

Open Access Article (/2073-4360/14/22/4861/pdf?version=1668157712)

Effect of the Addition of Nano-Silica and Poly(ε-caprolactone) on the Mechanical and Thermal Properties of Poly(lactic acid) Blends and Possible Application in Embossing Process (/2073-4360/14/22/4861)

Polymers **2022**, *14*(22), 4861; https://doi.org/10.3390/polym14224861 (https://doi.org/10.3390/polym14224861) - 11 Nov 2022

Open Access Article (/2073-4360/14/22/4860/pdf?version=1668155649)

Box–Behnken Design for Polycarbonate-Pigment Blending: Applications and Characterization Techniques (/2073-4360/14/22/4860)

Polymers **2022**, *14*(22), 4860; https://doi.org/10.3390/polym14224860 (https://doi.org/10.3390/polym14224860) - 11 Nov 2022

Open Access Article (/2073-4360/14/22/4859/pdf?version=1669002055)

New Class of Polymer Materials—Quasi-Nematic Colloidal Particle Self-Assemblies: The Case of Assemblies of Prolate Spheroidal Poly(Styrene/Polyglycidol) Particles (/2073-4360/14/22/4859)

Polymers **2022**, *14*(22), 4859; https://doi.org/10.3390/polym14224859 (https://doi.org/10.3390/polym14224859) - 11 Nov 2022

Open Access Article (/2073-4360/14/22/4858/pdf?version=1668677729)

Thermal and Mechanical Properties of Concrete Incorporating Silica Fume and Waste Rubber Powder (/2073-4360/14/22/4858)

Polymers **2022**, *14*(22), 4858; https://doi.org/10.3390/polym14224858 (https://doi.org/10.3390/polym14224858) - 11 Nov 2022

Open Access Article (/2073-4360/14/22/4857/pdf?version=1668154637)

Biodegradable Active Packaging Material Containing Grape Seed Ethanol Extract and Corn Starch/κ-Carrageenan Composite Film (/2073-4360/14/22/4857)

Polymers **2022**, *14*(22), 4857; https://doi.org/10.3390/polym14224857 (https://doi.org/10.3390/polym14224857) - 11 Nov 2022

Open Access Article (/2073-4360/14/22/4856/pdf?version=1668650623)

Composition Effects on the Morphology of PVA/Chitosan Electrospun Nanofibers (/2073-4360/14/22/4856)

Polymers **2022**, *14*(22), 4856; https://doi.org/10.3390/polym14224856 (https://doi.org/10.3390/polym14224856) - 11 Nov 2022

Open Access Review (/2073-4360/14/22/4855/pdf?version=1669195328)

Supramolecular Combination Cancer Therapy Based on Macrocyclic Supramolecular Materials (/2073-4360/14/22/4855)

Polymers **2022**, *14*(22), 4855; https://doi.org/10.3390/polym14224855 (https://doi.org/10.3390/polym14224855) - 11 Nov 2022

Open Access Article (/2073-4360/14/22/4854/pdf?version=1668675987)

Highly Efficient Adsorption of Tetracycline Using Chitosan-Based Magnetic Adsorbent (/2073-4360/14/22/4854)

Polymers **2022**, *14*(22), 4854; https://doi.org/10.3390/polym14224854 (https://doi.org/10.3390/polym14224854) - 11 Nov 2022

Open Access Article (/2073-4360/14/22/4853/pdf?version=1668754529)

MDPI (/)

[Recycling of EPDM via Continuous Thermo-Mechanical Devulcanization with Co-Rotating Twin-Screw Extruder (/2073-4360/14/22/4853)]

Polymers **2022**, *14*(22), 4853; https://doi.org/10.3390/polym14224853 (https://doi.org/10.3390/polym14224853) - 11 Nov 2022

(/toggle_desktop_layout_cookie)

Open Access Article (/2073-4360/14/22/4852/pdf?version=1668146774)

[Mechanical Characterization of Hybrid Nano-Filled Glass/Epoxy Composites (/2073-4360/14/22/4852)]

Polymers **2022**, *14*(22), 4852; https://doi.org/10.3390/polym14224852 (https://doi.org/10.3390/polym14224852) - 11 Nov 2022

Open Access Article (/2073-4360/14/22/4846/pdf?version=1668135046)

[Reliability-Based Design Analysis for FRP Reinforced Compression Yield Beams (/2073-4360/14/22/4846)]

Polymers **2022**, *14*(22), 4846; https://doi.org/10.3390/polym14224846 (https://doi.org/10.3390/polym14224846) - 11 Nov 2022

Open Access Article (/2073-4360/14/22/4851/pdf?version=1668595158)

[Numerical Investigation of the Elastic Properties of Polypropylene/Ultra High Molecular Weight Polyethylene Fiber inside a Composite Material Based on Its Aspect Ratio and Volume Fraction (/2073-4360/14/22/4851)]

Polymers **2022**, *14*(22), 4851; https://doi.org/10.3390/polym14224851 (https://doi.org/10.3390/polym14224851) - 10 Nov 2022

Open Access Article (/2073-4360/14/22/4850/pdf?version=1668137312)

[Synergy of Fiber Surface Chemistry and Flow: Multi-Phase Transcrystallization in Fiber-Reinforced Thermoplastics (/2073-4360/14/22/4850)]

Polymers **2022**, *14*(22), 4850; https://doi.org/10.3390/polym14224850 (https://doi.org/10.3390/polym14224850) - 10 Nov 2022

Open Access Article (/2073-4360/14/22/4849/pdf?version=1668084944)

[Hydrophobically Modified Gelatin Particles for Production of Liquid Marbles (/2073-4360/14/22/4849)]

Polymers **2022**, *14*(22), 4849; https://doi.org/10.3390/polym14224849 (https://doi.org/10.3390/polym14224849) - 10 Nov 2022

Open Access Article (/2073-4360/14/22/4848/pdf?version=1668596764)

[Analysis of Particle Variation Effect on Flexural Properties of Hollow Glass Microsphere Filled Epoxy Matrix Syntactic Foam Composites (/2073-4360/14/22/4848)]

Polymers **2022**, *14*(22), 4848; https://doi.org/10.3390/polym14224848 (https://doi.org/10.3390/polym14224848) - 10 Nov 2022

Open Access Review (/2073-4360/14/22/4847/pdf?version=1668248465)

[Poly(caprolactone)-*b*-poly(ethylene glycol)-Based Polymeric Micelles as Drug Carriers for Efficient Breast Cancer Therapy: A Systematic Review (/2073-4360/14/22/4847)]

Polymers **2022**, *14*(22), 4847; https://doi.org/10.3390/polym14224847 (https://doi.org/10.3390/polym14224847) - 10 Nov 2022

Open Access Article (/2073-4360/14/22/4845/pdf?version=1668076562)

[Study of Changes in Crystallinity and Functional Properties of Modified Sago Starch (*Metroxylon* sp.) Using Physical and Chemical Treatment (/2073-4360/14/22/4845)]

Polymers **2022**, *14*(22), 4845; https://doi.org/10.3390/polym14224845 (https://doi.org/10.3390/polym14224845) - 10 Nov 2022

Open Access Article (/2073-4360/14/22/4844/pdf?version=1668074029)

[Structure of Waste Hemp Stalks and Their Sound Absorbing Properties (/2073-4360/14/22/4844)]

Polymers **2022**, *14*(22), 4844; https://doi.org/10.3390/polym14224844 (https://doi.org/10.3390/polym14224844) - 10 Nov 2022

Open Access Article (/2073-4360/14/22/4843/pdf?version=1669216748)

[Sound Absorption Improvement in Porous Ferroelectret Polyethylene with Effective Piezoelectric Mechanism (/2073-4360/14/22/4843)]

Polymers **2022**, *14*(22), 4843; https://doi.org/10.3390/polym14224843 (https://doi.org/10.3390/polym14224843) - 10 Nov 2022

Open Access Article (/2073-4360/14/22/4842/pdf?version=1668071131)

[A Holistic Approach to Cooling System Selection and Injection Molding Process Optimization Based on Non-Dominated Sorting (/2073-4360/14/22/4842)]

Polymers **2022**, *14*(22), 4842; https://doi.org/10.3390/polym14224842 (https://doi.org/10.3390/polym14224842) - 10 Nov 2022

Open Access Article (/2073-4360/14/22/4841/pdf?version=1669079911)

[Gold-Nanoparticle-Enhanced Radio-Fluorogenic Hydrogel Sensor for Low Radiation Doses in Clinical Radiotherapy (/2073-4360/14/22/4841)]

Polymers **2022**, *14*(22), 4841; https://doi.org/10.3390/polym14224841 (https://doi.org/10.3390/polym14224841) - 10 Nov 2022

Open Access Article (/2073-4360/14/22/4840/pdf?version=1668070062)

[Cellulose in Secondary Xylem of Cactaceae: Crystalline Composition and Anatomical Distribution (/2073-4360/14/22/4840)]

Polymers **2022**, *14*(22), 4840; https://doi.org/10.3390/polym14224840 (https://doi.org/10.3390/polym14224840) - 10 Nov 2022

Open Access Review (/2073-4360/14/22/4839/pdf?version=1669086328)

[Multifunctional Polymeric Micelles for Cancer Therapy (/2073-4360/14/22/4839)]

Polymers **2022**, *14*(22), 4839; https://doi.org/10.3390/polym14224839 (https://doi.org/10.3390/polym14224839) - 10 Nov 2022

Open Access Article (/2073-4360/14/22/4838/pdf?version=1668068319)

Effect of Different Types of Aluminosilicates on the Thermo-Mechanical Properties of Metakaolinite-Based Geopolymer Composites (/2073-4360/14/22/4838)

Polymers **2022**, *14*(22), 4838; https://doi.org/10.3390/polym14224838 (https://doi.org/10.3390/polym14224838) - 10 Nov 2022

Open Access Article (/2073-4360/14/22/4837/pdf?version=1668069542)

Study on the Failure Mechanism of a Modified Hydrophilic Polyurethane Material Pisha Sandstone System under Dry–Wet Cycles (/2073-4360/14/22/4837)

Polymers **2022**, *14*(22), 4837; https://doi.org/10.3390/polym14224837 (https://doi.org/10.3390/polym14224837) - 10 Nov 2022

Open Access Article (/2073-4360/14/22/4836/pdf?version=1669083207)

Tailoring and Long-Term Preservation of the Properties of PLA Composites with “Green” Plasticizers (/2073-4360/14/22/4836)

Polymers **2022**, *14*(22), 4836; https://doi.org/10.3390/polym14224836 (https://doi.org/10.3390/polym14224836) - 10 Nov 2022

Open Access Article (/2073-4360/14/22/4835/pdf?version=1668065071)

Automated Parallel Dialysis for Purification of Polymers (/2073-4360/14/22/4835)

Polymers **2022**, *14*(22), 4835; https://doi.org/10.3390/polym14224835 (https://doi.org/10.3390/polym14224835) - 10 Nov 2022

Open Access Article (/2073-4360/14/22/4834/pdf?version=1668058778)

The Influence of Isoenzyme Composition and Chemical Modification on Horseradish Peroxidase@ZIF-8 Biocomposite Performance (/2073-4360/14/22/4834)

Polymers **2022**, *14*(22), 4834; https://doi.org/10.3390/polym14224834 (https://doi.org/10.3390/polym14224834) - 10 Nov 2022

Open Access Review (/2073-4360/14/22/4833/pdf?version=1668060031)

Recent Advances of Hyaluronan for Skin Delivery: From Structure to Fabrication Strategies and Applications (/2073-4360/14/22/4833)

Polymers **2022**, *14*(22), 4833; https://doi.org/10.3390/polym14224833 (https://doi.org/10.3390/polym14224833) - 10 Nov 2022

Open Access Editorial (/2073-4360/14/22/4832/pdf?version=1668048805)

Special Issue “Mechanical Performance of Sustainable Bio-Based Compounds” (/2073-4360/14/22/4832)

Polymers **2022**, *14*(22), 4832; https://doi.org/10.3390/polym14224832 (https://doi.org/10.3390/polym14224832) - 10 Nov 2022

Open Access Review (/2073-4360/14/22/4831/pdf?version=1668045609)

Bibliometrics of Functional Polymeric Biomaterials with Bioactive Properties Prepared by Radiation-Induced Graft Copolymerisation: A Review (/2073-4360/14/22/4831)

Polymers **2022**, *14*(22), 4831; https://doi.org/10.3390/polym14224831 (https://doi.org/10.3390/polym14224831) - 10 Nov 2022

Open Access Article (/2073-4360/14/22/4830/pdf?version=1668589878)

Impact of Micro Silica Filler Particle Size on Mechanical Properties of Polymeric Based Composite Material (/2073-4360/14/22/4830)

Polymers **2022**, *14*(22), 4830; https://doi.org/10.3390/polym14224830 (https://doi.org/10.3390/polym14224830) - 09 Nov 2022

Open Access Article (/2073-4360/14/22/4829/pdf?version=1668651822)

Catalytic Reduction of Dyes and Antibacterial Activity of AgNPs@Zn@Alginate Composite Aerogel Beads (/2073-4360/14/22/4829)

Polymers **2022**, *14*(22), 4829; https://doi.org/10.3390/polym14224829 (https://doi.org/10.3390/polym14224829) - 09 Nov 2022

Open Access Article (/2073-4360/14/22/4828/pdf?version=1668591053)

Full Recycling and Re-Use of Bio-Based Epoxy Thermosets: Chemical and Thermomechanical Characterization of the Recycled Matrices (/2073-4360/14/22/4828)

Polymers **2022**, *14*(22), 4828; https://doi.org/10.3390/polym14224828 (https://doi.org/10.3390/polym14224828) - 09 Nov 2022

Open Access Article (/2073-4360/14/22/4827/pdf?version=1668000664)

Nanocrystallization Improves the Solubilization and Cytotoxic Effect of a Poly (ADP-Ribose)-Polymerase-I Inhibitor (/2073-4360/14/22/4827)

Polymers **2022**, *14*(22), 4827; https://doi.org/10.3390/polym14224827 (https://doi.org/10.3390/polym14224827) - 09 Nov 2022

Open Access Article (/2073-4360/14/22/4826/pdf?version=1667997278)

New Insight into Rubber Composites Based on Graphene Nanoplatelets, Electrolyte Iron Particles, and Their Hybrid for Stretchable Magnetic Materials (/2073-4360/14/22/4826)

Polymers **2022**, *14*(22), 4826; https://doi.org/10.3390/polym14224826 (https://doi.org/10.3390/polym14224826) - 09 Nov 2022

Open Access Review (/2073-4360/14/22/4825/pdf?version=1667990531)

Acellular Tissue-Engineered Vascular Grafts from Polymers: Methods, Achievements, Characterization, and Challenges (/2073-4360/14/22/4825)

Polymers **2022**, *14*(22), 4825; https://doi.org/10.3390/polym14224825 (https://doi.org/10.3390/polym14224825) - 09 Nov 2022

Open Access Review (/2073-4360/14/22/4824/pdf?version=1667996799)

Polyborosiloxanes (PBS): Evolution of Approaches to the Synthesis and the Prospects of Their Application (/2073-4360/14/22/4824)

Polymers **2022**, *14*(22), 4824; https://doi.org/10.3390/polym14224824 (https://doi.org/10.3390/polym14224824) - 09 Nov 2022

Open Access Article (/2073-4360/14/22/4823/pdf?version=1667990433)

MDPI (/)

[A Comparative Study of PMETAC-Modified Mesoporous Silica and Titania Thin Films for Molecular Transport Manipulation (/2073-4360/14/22/4823)]

Polymers **2022**, *14*(22), 4823; https://doi.org/10.3390/polym14224823 (https://doi.org/10.3390/polym14224823) - 09 Nov 2022

(/toggle_desktop_layout_cookie)

Open Access Article (/2073-4360/14/22/4822/pdf?version=1667989660)

Effects of Rotational Speed on Joint Characteristics of Green Joining Technique of Dissimilar Polymeric Rods Fabricated by Additive Manufacturing Technology (/2073-4360/14/22/4822)

Polymers **2022**, *14*(22), 4822; https://doi.org/10.3390/polym14224822 (https://doi.org/10.3390/polym14224822) - 09 Nov 2022

Open Access Article (/2073-4360/14/22/4821/pdf?version=1667988482)

Chitosan Nanoparticles as Bioactive Vehicles for Textile Dyeing: A Proof of Concept (/2073-4360/14/22/4821)

Polymers **2022**, *14*(22), 4821; https://doi.org/10.3390/polym14224821 (https://doi.org/10.3390/polym14224821) - 09 Nov 2022

Open Access Article (/2073-4360/14/22/4820/pdf?version=1667999544)

Physical and Mechanical Properties of Novel Multilayer Bamboo Laminated Composites Derived from Bamboo Veneer (/2073-4360/14/22/4820)

Polymers **2022**, *14*(22), 4820; https://doi.org/10.3390/polym14224820 (https://doi.org/10.3390/polym14224820) - 09 Nov 2022

Open Access Article (/2073-4360/14/22/4819/pdf?version=1667988715)

Towards a Whole Sample Imaging Approach Using Diffusion Tensor Imaging to Examine the Foreign Body Response to Explanted Medical Devices (/2073-4360/14/22/4819)

Polymers **2022**, *14*(22), 4819; https://doi.org/10.3390/polym14224819 (https://doi.org/10.3390/polym14224819) - 09 Nov 2022

Open Access Article (/2073-4360/14/22/4818/pdf?version=1667986664)

Synthesis and Iodine Adsorption Properties of Organometallic Copolymers with Propeller-Shaped Fe(II) Clathrochelates Bridged by Different Diaryl Thioether and Their Oxidized Sulfone Derivatives (/2073-4360/14/22/4818)

Polymers **2022**, *14*(22), 4818; https://doi.org/10.3390/polym14224818 (https://doi.org/10.3390/polym14224818) - 09 Nov 2022

Open Access Article (/2073-4360/14/22/4817/pdf?version=1667986304)

Multifunctional Performance of Hybrid $SrFe_{12}O_{19}/BaTiO_3$/Epoxy Resin Nanocomposites (/2073-4360/14/22/4817)

Polymers **2022**, *14*(22), 4817; https://doi.org/10.3390/polym14224817 (https://doi.org/10.3390/polym14224817) - 09 Nov 2022

Open Access Article (/2073-4360/14/22/4816/pdf?version=1667986130)

Reinforcement Effects of Shear Thickening Fluid over Mechanical Properties of Nonwoven Fabrics (/2073-4360/14/22/4816)

Polymers **2022**, *14*(22), 4816; https://doi.org/10.3390/polym14224816 (https://doi.org/10.3390/polym14224816) - 09 Nov 2022

Open Access Article (/2073-4360/14/22/4815/pdf?version=1667991681)

Syndiotactic Poly(4-methyl-1-pentene)-Based Stereoregular Diblock Copolymers: Synthesis and Self-Assembly Studies (/2073-4360/14/22/4815)

Polymers **2022**, *14*(22), 4815; https://doi.org/10.3390/polym14224815 (https://doi.org/10.3390/polym14224815) - 09 Nov 2022

Open Access Article (/2073-4360/14/22/4814/pdf?version=1667983990)

All-Solid State Potentiometric Sensors for Desvenlafaxine Detection Using Biomimetic Imprinted Polymers as Recognition Receptors (/2073-4360/14/22/4814)

Polymers **2022**, *14*(22), 4814; https://doi.org/10.3390/polym14224814 (https://doi.org/10.3390/polym14224814) - 09 Nov 2022

Open Access Article (/2073-4360/14/22/4813/pdf?version=1667982649)

Novel In Situ Modification for Thermoplastic Starch Preparation based on *Arenga pinnata* Palm Starch (/2073-4360/14/22/4813)

Polymers **2022**, *14*(22), 4813; https://doi.org/10.3390/polym14224813 (https://doi.org/10.3390/polym14224813) - 09 Nov 2022

Open Access Article (/2073-4360/14/22/4812/pdf?version=1669098533)

Acceleration of Bone Fracture Healing through the Use of Bovine Hydroxyapatite or Calcium Lactate Oral and Implant Bovine Hydroxyapatite–Gelatin on Bone Defect Animal Model (/2073-4360/14/22/4812)

Polymers **2022**, *14*(22), 4812; https://doi.org/10.3390/polym14224812 (https://doi.org/10.3390/polym14224812) - 09 Nov 2022

Open Access Article (/2073-4360/14/22/4811/pdf?version=1667985984)

Dyeing Non-Recyclable Polyethylene Plastic with Photoacid Phycocyanobilin from Spirulina Algae: Ultrafast Photoluminescence Studies (/2073-4360/14/22/4811)

Polymers **2022**, *14*(22), 4811; https://doi.org/10.3390/polym14224811 (https://doi.org/10.3390/polym14224811) - 09 Nov 2022

Open Access Article (/2073-4360/14/22/4810/pdf?version=1667979882)

Experimental and Numerical Investigation of Joints for a Pultruded Fiber-Reinforced Polymer Truss (/2073-4360/14/22/4810)

Polymers **2022**, *14*(22), 4810; https://doi.org/10.3390/polym14224810 (https://doi.org/10.3390/polym14224810) - 09 Nov 2022

Open Access Article (/2073-4360/14/22/4809/pdf?version=1668079114)

Sensitive Organic Vapor Sensors Based on Flexible Porous Conductive Composites with Multilevel Pores and Thin, Rough, Hollow-Wall Structure (/2073-4360/14/22/4809)

Polymers **2022**, *14*(22), 4809; **https://doi.org/10.3390/polym14224809 (https://doi.org/10.3390/polym14224809)** - 09 Nov 2022

Open Access Article (/2073-4360/14/22/4808/pdf?version=1667959786)

Measuring Structural Changes in Cytochrome *c* under Crowded Conditions Using In Vitro and In Silico Approaches (/2073-4360/14/22/4808)

Polymers **2022**, *14*(22), 4808; **https://doi.org/10.3390/polym14224808 (https://doi.org/10.3390/polym14224808)** - 09 Nov 2022

Open Access Article (/2073-4360/14/22/4807/pdf?version=1669258772)

Effect of Piezoelectric $BaTiO_3$ Filler on Mechanical and Magnetoelectric Properties of $Zn_{0.25}Co_{0.75}Fe_2O_4$/PVDF-TrFE Composites (/2073-4360/14/22/4807)

Polymers **2022**, *14*(22), 4807; **https://doi.org/10.3390/polym14224807 (https://doi.org/10.3390/polym14224807)** - 08 Nov 2022

Open Access Article (/2073-4360/14/22/4806/pdf?version=1668605196)

Silk Fibroin Hydrogels Incorporated with the Antioxidant Extract of *Stryphnodendron adstringens* Bark (/2073-4360/14/22/4806)

Polymers **2022**, *14*(22), 4806; **https://doi.org/10.3390/polym14224806 (https://doi.org/10.3390/polym14224806)** - 08 Nov 2022

Open Access Article (/2073-4360/14/22/4805/pdf?version=1668502131)

The Structural Evolution and Mechanical Properties of Semi-Aromatic Polyamide 12T after Stretching (/2073-4360/14/22/4805)

Polymers **2022**, *14*(22), 4805; **https://doi.org/10.3390/polym14224805 (https://doi.org/10.3390/polym14224805)** - 08 Nov 2022

Open Access Review (/2073-4360/14/22/4804/pdf?version=1668594059)

Recent Advances in Porous Polymers for Solid-State Rechargeable Lithium Batteries (/2073-4360/14/22/4804)

Polymers **2022**, *14*(22), 4804; **https://doi.org/10.3390/polym14224804 (https://doi.org/10.3390/polym14224804)** - 08 Nov 2022

Open Access Article (/2073-4360/14/22/4803/pdf?version=1668588074)

Thermoelectric Properties of N-Type Poly (Ether Ether Ketone)/Carbon Nanofiber Melt-Processed Composites (/2073-4360/14/22/4803)

Polymers **2022**, *14*(22), 4803; **https://doi.org/10.3390/polym14224803 (https://doi.org/10.3390/polym14224803)** - 08 Nov 2022

Open Access Article (/2073-4360/14/22/4802/pdf?version=1668757134)

Computational Foretelling and Experimental Implementation of the Performance of Polyacrylic Acid and Polyacrylamide Polymers as Eco-Friendly Corrosion Inhibitors for Copper in Nitric Acid (/2073-4360/14/22/4802)

Polymers **2022**, *14*(22), 4802; **https://doi.org/10.3390/polym14224802 (https://doi.org/10.3390/polym14224802)** - 08 Nov 2022

Open Access Article (/2073-4360/14/22/4801/pdf?version=1669023504)

Effect of Kaolin Clay and ZnO-Nanoparticles on the Radiation Shielding Properties of Epoxy Resin Composites (/2073-4360/14/22/4801)

Polymers **2022**, *14*(22), 4801; **https://doi.org/10.3390/polym14224801 (https://doi.org/10.3390/polym14224801)** - 08 Nov 2022

Open Access Article (/2073-4360/14/22/4800/pdf?version=1667911256)

Tailored Supersaturable Immediate Release Behaviors of Hypotensive Supersaturating Drug-Delivery Systems Combined with Hot-Melt Extrusion Technique and Self-Micellizing Polymer (/2073-4360/14/22/4800)

Polymers **2022**, *14*(22), 4800; **https://doi.org/10.3390/polym14224800 (https://doi.org/10.3390/polym14224800)** - 08 Nov 2022

Open Access Article (/2073-4360/14/22/4799/pdf?version=1669086052)

Preparation and Characterization of Polyanhydride Terminated with Oleic Acid Extracted from Olive Mills Waste (/2073-4360/14/22/4799)

Polymers **2022**, *14*(22), 4799; **https://doi.org/10.3390/polym14224799 (https://doi.org/10.3390/polym14224799)** - 08 Nov 2022

Open Access Article (/2073-4360/14/22/4798/pdf?version=1667912550)

Experimental Study of Injection Molding Replicability for the Micro Embossment of the Ultrasonic Vibrator (/2073-4360/14/22/4798)

Polymers **2022**, *14*(22), 4798; **https://doi.org/10.3390/polym14224798 (https://doi.org/10.3390/polym14224798)** - 08 Nov 2022

Open Access Article (/2073-4360/14/22/4797/pdf?version=1668579334)

Surface Modifications of Polyetheretherketone (PEEK): Results from the Literature and Special Studies of Copper-Coated Films (/2073-4360/14/22/4797)

Polymers **2022**, *14*(22), 4797; **https://doi.org/10.3390/polym14224797 (https://doi.org/10.3390/polym14224797)** - 08 Nov 2022

Open Access Review (/2073-4360/14/22/4796/pdf?version=1667904954)

Recent Studies on Thermally Conductive 3D Aerogels/Foams with the Segregated Nanofiller Framework (/2073-4360/14/22/4796)

Polymers **2022**, *14*(22), 4796; **https://doi.org/10.3390/polym14224796 (https://doi.org/10.3390/polym14224796)** - 08 Nov 2022

Open Access Article (/2073-4360/14/22/4795/pdf?version=1667911946)

On Crashworthiness and Energy-Absorbing Mechanisms of Thick CFRP Structures for Railway Vehicles (/2073-4360/14/22/4795)

Polymers **2022**, *14*(22), 4795; **https://doi.org/10.3390/polym14224795 (https://doi.org/10.3390/polym14224795)** - 08 Nov 2022

Open Access Article (/2073-4360/14/22/4794/pdf?version=1667903784)

Uncertainties in Electric Circuit Analysis of Anisotropic Electrical Conductivity and Piezoresistivity of Carbon Nanotube Nanocomposites (/2073-4360/14/22/4794)

Polymers **2022**, *14*(22), 4794; **https://doi.org/10.3390/polym14224794 (https://doi.org/10.3390/polym14224794)** - 08 Nov 2022

MDPI (/)

Open Access Review

(/2073-4360/14/22/4793/pdf?version=1668732175)

Brief Review of PVDF Properties and Applications Potential (/2073-4360/14/22/4793)

(/toggle_desktop_layout_cookie)

Polymers **2022**, *14*(22), 4793; **https://doi.org/10.3390/polym14224793 (https://doi.org/10.3390/polym14224793)** - 08 Nov 2022

Open Access Article

(/2073-4360/14/22/4792/pdf?version=1667899654)

The Fabrication of Solid Polymer Electrolyte from CS/PEO/$NaClO_4$/Fly Ash Composite (/2073-4360/14/22/4792)

Polymers **2022**, *14*(22), 4792; **https://doi.org/10.3390/polym14224792 (https://doi.org/10.3390/polym14224792)** - 08 Nov 2022

Open Access Article

(/2073-4360/14/22/4791/pdf?version=1668567244)

Integrated Approach to Eco-Friendly Thermoplastic Composites Based on Chemically Recycled PET Co-Polymers Reinforced with Treated Banana Fibres (/2073-4360/14/22/4791)

Polymers **2022**, *14*(22), 4791; **https://doi.org/10.3390/polym14224791 (https://doi.org/10.3390/polym14224791)** - 08 Nov 2022

Open Access Article

(/2073-4360/14/22/4790/pdf?version=1668505186)

Study on the Extrusion Molding Process of Polylactic Acid Micro Tubes for Biodegradable Vascular Stents (/2073-4360/14/22/4790)

Polymers **2022**, *14*(22), 4790; **https://doi.org/10.3390/polym14224790 (https://doi.org/10.3390/polym14224790)** - 08 Nov 2022

Open Access Article

(/2073-4360/14/22/4789/pdf?version=1668567987)

Study on Bending Creep Performance of GFRP-Reinforced PVC-Based Wood-Plastic Composite Panels (/2073-4360/14/22/4789)

Polymers **2022**, *14*(22), 4789; **https://doi.org/10.3390/polym14224789 (https://doi.org/10.3390/polym14224789)** - 08 Nov 2022

Open Access Review

(/2073-4360/14/22/4788/pdf?version=1667870184)

Plastic Waste Upcycling: A Sustainable Solution for Waste Management, Product Development, and Circular Economy (/2073-4360/14/22/4788)

Polymers **2022**, *14*(22), 4788; **https://doi.org/10.3390/polym14224788 (https://doi.org/10.3390/polym14224788)** - 08 Nov 2022

***Polymers* (/journal/polymers)**, EISSN 2073-4360, Published by MDPI *polymers*

Article

Acceleration of Bone Fracture Healing through the Use of Bovine Hydroxyapatite or Calcium Lactate Oral and Implant Bovine Hydroxyapatite–Gelatin on Bone Defect Animal Model

Aniek Setiya Budiatin [1,*], Junaidi Khotib [1], Samirah Samirah [1], Chrismawan Ardianto [1], Maria Apriliani Gani [1], Bulan Rhea Kaulika Hadinar Putri [1], Huzaifah Arofik [1], Rizka Nanda Sadiwa [1], Indri Lestari [1], Yusuf Alif Pratama [1], Erreza Rahadiansyah [2] and Imam Susilo [3]

1 Department of Pharmacy Practice, Faculty of Pharmacy, Universitas Airlangga, Surabaya 60115, Indonesia
2 Department of Orthopaedics and Traumatology, Faculty of Medicine, Universitas Airlangga, Surabaya 60131, Indonesia
3 Department of Anatomical Pathology, Faculty of Medicine, Universitas Airlangga, Surabaya 60131, Indonesia
* Correspondence: anieksb@yahoo.co.id

Abstract: Bone grafts a commonly used therapeutic technique for the reconstruction and facilitation of bone regeneration due to fractures. BHA–GEL (bovine hydroxyapatite–gelatin) pellet implants have been shown to be able accelerate the process of bone repair by looking at the percentage of new bone, and the contact between the composite and bone. Based on these results, a study was conducted by placing BHA–GEL (9:1) pellet implants in rabbit femoral bone defects, accompanied by 500 mg oral supplement of BHA or calcium lactate to determine the effectiveness of addition supplements. The research model used was a burr hole defect model with a diameter of 4.2 mm in the cortical part of the rabbit femur. On the 7th, 14th and 28th days after treatment, a total of 48 New Zealand rabbits were divided into four groups, namely defect (control), implant, implant + oral BHA, and implant + oral calcium lactate. Animal tests were terminated and evaluated based on X-ray radiology results, *Hematoxylin-Eosin* staining, vascular endothelial growth Factor (VEGF), osteocalcin, and enzyme-linked immunosorbent assay (ELISA) for bone alkaline phosphatase (BALP) and calcium levels. From this research can be concluded that Oral BHA supplementation with BHA–GEL pellet implants showed faster healing of bone defects compared to oral calcium lactate with BHA–GEL pellet implants.

Keywords: defect; bone remodeling; bovine hydroxyapatite; calcium lactate; BHA–GEL pellet

Citation: Budiatin, A.S.; Khotib, J.; Samirah, S.; Ardianto, C.; Gani, M.A.; Putri, B.R.K.H.; Arofik, H.; Sadiwa, R.N.; Lestari, I.; Pratama, Y.A.; et al. Acceleration of Bone Fracture Healing through the Use of Bovine Hydroxyapatite or Calcium Lactate Oral and Implant Bovine Hydroxyapatite–Gelatin on Bone Defect Animal Model. *Polymers* **2022**, *14*, 4812. https://doi.org/10.3390/polym14224812

Academic Editors: Antonia Ressler and Inga Urlic

Received: 29 August 2022
Accepted: 26 October 2022
Published: 9 November 2022

1. Introduction

Bone is a special connective tissue that hardens via the process of mineralization by calcium phosphate in the form of hydroxyapatite [1]. Various kinds of bone, joint, and muscle diseases in humans include open fractures, closed fractures, osteoporosis, osteoarthritis, osteomalacia, osteomyelitis, rheumatic polymyalgia, gouty arthritis, rheumatoid arthritis and others, with fractures being the most common large organ traumatic injury in humans [2]. A fracture is neuromuscular damage due to trauma to the tissue [3] and results in a gap in the bone. Fracture repair can generally restore damaged skeletal organs to their preinjury cellular composition, structure, and biomechanical function, but about 10% of fractures will not heal normally [2]. In 2011, the World Health Organization (WHO) recorded more than 1.3 million people suffering from fractures due to accidents. Accident cases that have a fairly high prevalence, amongst which are lower extremity fractures, reprsent 40% of the accidents that occur. Bone graft therapy, with a surgical procedure that places new bone or replacement material (composite matrix) into the space around the fracture or hole in the damaged bone (defect) to help speed up the healing process [3], is commonly used in fracture management [4].

Bovine hydroxyapatite (BHA) is an inorganic bovine bone material used as an alternative composite component, consisting of 93% hydroxyapatite ($Ca_{10}(PO_4)_6(OH)_2$) and 7% β-tricalcium phosphate ($Ca_3(PO_4)_2$). As a result, it is more porous and can only absorb antibiotics, hormones or growth factors [5]. BHA has properties similar to hydroxyapatite in human bone and is a scaffold that is more osteoconductive than other synthetic hydroxyapatites, is biocompatible and has high porosity. The high porosity of BHA accelerates the process of colonization of osteoblast cells and becomes a medium for osteoblast cells to stick to [6]. On the other hand, BHA is brittle as a new bone-forming material, so gelatin is added as an adhesive and smoothing agent [5]. Gelatin (GEL) is a macromolecule produced by partial hydrolysis of collagen from skin, white connective tissue and animal bones of amino acid residues [7]. GEL is commonly called type one collagen which together with osteoblasts forms osteoids (soft callus). BHA–GEL composites that resemble mineral components in humans are able to form new bone and fill bone gaps due to fractures [5] with high biocompatible properties, osteoconductive, osteoinductive, biodegradable, bioresorbable, and non-toxic [8,9]. The addition of gelatin can also control the degradation of pellet time and increase the synthesis of new bone in the defect area [10].

BHA–GEL composite implants have been shown to be able to accelerate the bone repair process in fractured rabbit femurs within 28 to 42 days, and have good biomaterials for bone filling [11]. However, this period of time is still relatively long when considering the effect of pain felt by patients with fractured bones, and can affect the patient's psychological (anxiety) level [12]. Repair of bone mineralization alone is not sufficient to meet demand and can affect skeletons with inadequate bone tissue function. It is necessary to increase the supply of calcium. Simple calcium preparations are generally administered orally as an adjuvant to treatment, in combination with more specific drugs [13]. For this reason, a study was carried out on bone defects due to fractures with BHA–GEL pellet implants and the addition of BHA or calcium lactate orally as calcium supplements. Calcium intake plays an important role in maintaining bone health, namely to achieve peak bone mass and prevent loss of bone mass [14]. The purpose of supplementation in this study was to prove that the period of bone growth around the defect could be shortened. Osteoblast proliferation is expected to increase with the addition of oral BHA supplements to form more osteoids (soft callus), which are then converted into osteocytes (hard callus) and can increase bone stability around the fracture.

BHA is known to have carbonate substitutions like that of human hydroxyapatite and that can be found in synthetic biomimetic hydroxyapatites [15,16]. The carbonate group increases the proliferation of osteoblasts, thereby accelerating the formation of new bone [17]. Hydroxyapatite raises blood calcium levels less than calcium carbonate and calcium citrate. This indicates that hydroxyapatite is more effective at entering bone cells [18]. BHA bioavailability is better than calcium carbonate [14] and absorbed about 42.5% [19]. A European study showed that hydroxyapatite was more effective than calcium carbonate in slowing bone loss of the peripheral trabeculae of the distal tibia and distal radius [14]. The role of oral BHA is to increase the proliferation of osteoblasts by stimulating mesenchymal cells. It is shown by the calcium deposition from hydroxyapatite will interact with the collagen fibers along with type I collagen, a substance from the degradation of gelatin. During the mineralization process, the ends of the bone fragments are covered by a fusiform mass filled with woven bone. The more minerals deposited, the harder the callus formed [20]. While calcium lactate which is a salt form of lactic acid in the form of white powder, crystals or grains [21], which is also given orally because it can increase the number of osteoblasts [22]. Calcium lactate intake can increase extracellular calcium and intracellular calcium levels, stimulating bone formation significantly and increasing the proliferation or chemotaxis of osteoblasts [22]. Calcium lactate also significantly reduces bone resorption [23]. In addition, calcium lactate in the body is easily converted into calcium bicarbonate, and only about 25% is absorbed in the small intestine from calcium intake through passive diffusion and active transport [24]. A study shows a comparison of 500 mg calcium lactate, 500 mg carbonate and 500 mg gluconate (it is known that each calcium content is different), the results of which show the absorption, AUC and excretion of calcium lactate to be better than others [25]. Calcium lactate absorption is better than calcium phosphate and calcium in milk, and stimulates bone activity more than calcium carbonate or calcium citrate in experimental rats. As a consequence, it is very effective, especially in bone metabolism [22]. However, based on the research of previous results, it is known that BHA has more osteoinductive properties that other materials do not have [26]. For this reason, it is possible that oral administration of BHA on BHA–GEL pellet implants is more effective in terms of bone growth than oral administration of calcium lactate on BHA–GEL pellet implants.

2. Materials and Methods

2.1. Ethical Approval

The submission of an ethical feasibility proposal was addressed to the Research Ethics Commission of the Faculty of Veterinary Medicine, Universitas Airlangga (Animal Care and Use Committee/ACUC) and has been declared ethically eligible via Ethical Clearence No. 2.KEH.075.05.2022.

The research was conducted in the laboratory of the Faculty of Pharmacy, Universitas Airlangga, Surabaya in a true experimental manner with a posttest-only control group study design using 48 New Zealand rabbits aged 4–8 months, weighing 1.5–2.5 kg, healthy and without bone disorders in femur. The rabbits were randomly divided into defect (control groups), BHA–GEL pellet implant group, BHA–GEL pellet implant group with oral BHA and BHA–GEL pellet implant group with oral calcium lactate. Rabbits were adapted for one week with adequate food provided during the study. Making a rabbit fracture model was made by generating a defect in the femur, followed by implanting a BHA–GEL pellet implant according to the group division. Furthermore, oral supplements of BHA or calcium lactate were administered until termination was carried out on days 7, 14 and 28, according to group division. After termination, the femur bone that was treated as a sample was taken; this was followed by evaluation through X-ray radiology, and then bone decalcification, to evaluate the number and distribution of bone cells through HE (*Hematoxylin-Eosin*) staining, evaluation of anti-vascular endothelial growth factor (VEGF) and osteocalcin levels using the immunohistochemical (IHC) method.

2.2. Materials

In terms of test materials, bovine hydroxyapatite (Universitas Airlangga, Indonesia), gelatin, sodium carboxymethyl cellulose powder, aquadest, ketamine, xylazine, gentamicin ointment, ampicillin, 70% alcohol (pharmaceutical grade), cotton balls, povidone iodine, savlon, cotton bud, sterile gauze, hypafix, handsaplast, calcium lactate 500 mg tablet, thrombophob gel, water for injection, 10% formalin buffer, and a Calcium Colorimetric Assay Kit, ELISA Kit (Cat No. MAK022) (Sigma-aldrich, St. Louis, MO, USA) were acquired. In terms of equipment, a Carver manual pellet press, punch and die (4 mm diameter), 1 cc and 3 cc syringe, bone drill with 4.2 mm drill bit, surgical blade, forceps, needle holder, needle circle or surgical needles, Silk no.3 surgical thread, gillette razor, shaver, tweezers, scissors, leukoplast, vacutainer gel separator, water bath, mortar, stamper, granule sieve, oven, feeding tube, oral catheter, X-ray machine, ELISA reader, light microscope, histology slides, object glass and cover glass were used.

2.3. BHA–GEL Pellet Preparation

Weigh and put 9 g Bovine hydroxyapatite (BHA) powder into a mortar and then reduce the particle size using a stamper. Heat 6 mL of distilled water in a glass beaker at 40 °C, then add 2 g of gelatin and stir until the gelatin dissolves. Put 3 mL of dissolved gelatin into a mortar containing BHA and stir until the mass is formed. Next, sieve the mass to obtain a uniform particle size and dry in an oven at 40 °C for 24 h. Weigh the granules as large as 100 mg and compress with a load of 1 ton with a diameter of 4 mm to form BHA–GEL pellets, and continue with UV sterilization for ±3 h.

Implantation of BHA–GEL implant and oral administration of BHA or oral calcium lactate is performed by injecting a combination anesthetic ketamine 50 mg/kgBW and xylazine 5 mg/kgBW intramuscularly in experimental animals. Clean the rabbit's thighs with 70% alcohol and shave. Disinfect the shaved area using betadine then make an incision in the required area of about 1.5 cm. The defect was made using a 4.2 mm drill bit and followed by implantation of BHA–GEL pellets. Next, suture the wound, disinfect it with 70% alcohol and then betadine, and then apply gentamicin ointment as an antibiotic. Cover the wound with sterile gauze and dressing retention tape, then administer injection of Ampicillin intramuscularly at a dose of 25 mg/kgBW as an antibiotic. During the recovery period, the wound was treated with betadine and tape replacement until the surgical wound was dry. In addition, the rabbits were treated with 1 mL oral BHA or calcium lactate according to the group division.

2.4. Characterizations of Pellet

The characterization of the prepared pellets was carried out using Fourier Transform Infrared (FT-IR) Spectroscopy (Perkin Elmer, MA, USA). The BHA, Gelatin, and BHA–GELatin that have been made were then mixed with potassium bromide to make pellets and measured at a wave number of 400–4000 cm^{-1} with only one scanning, while the size and morphology of the particles were observed using scanning electron microscopy (Inspect S-50, FEI, Japan). The sputter coating of SEM used the ultra-thin coating of gold.

2.5. Blood Sampling Technique

Xylol was applied to the rabbit's ear on the marginal vein and 3 mL of blood were using a disposable syringe one hour from the time of taking the drug; this was carried out on the 7th, 14th, and 28th days before termination. Applying heparin gel to the area around the injection to prevent blood clots. Inject blood into a vacutainer containing a gel separator (serum separator tube) (OneMed, Krian, Indonesia) slowly to prevent hemolysis. Continue to centrifuge at 4000 rpm for 15 min to obtain a serum. Serum was stored in the freezer at −80 °C. BALP levels were using ELISA microplate reader IMark series No. 12096 (Bio-Rad, Hercules, CA, USA), while calcium levels using a microplate reader Biochrom EZ Read 2000 serial num-ber 135247 (Biochrom Ltd, Cambridge, United Kingdom.

2.6. Bone Sampling Technique

Termination of the experimental rabbits on the 7th, 14th and 28th days after treatment with oral drugs was performed in the instance of both BHA and calcium lactate. A bone sample of the femur in a 10% formalin was followed followed by observation of the process of closing the bone gap by X-ray radiology. Then decalcification of bone in 10% EDTA solution for observation of bone cell development through HE staining (*Hematoxylin-Eosin*), examination of VEGF and osteocalcin levels using the immunohistochemical (IHC) method.

2.7. Radiology Examination

An evaluation of bone integrity was performed using X-ray radiography and clarified with *ImageJ V1.44p*, before then compared being with the initial diameter of the bone defect (4.2 mm). This was followed by macroscopic observations to see the percentage of callus growth around the bone defect and calculations using Lane–Sandhu Scoring (Table 1).

Table 1. Lane–Sandhu Scoring Criteria [27].

Criteria	Score	Characteristics
No callus	0	no callus tissue, fracture line clear
Minimal callus	1	25% callus tissue, fracture line still clearly visible
Callus evident but healing incomplete	2	50% callus tissue, fracture line blurred
Callus evident with stability expected	3	75% callus tissue, fracture line barely visible
Complete healing with bone remodeling	4	100% callus tissue, no remaining fracture line visible

2.8. Haematoxylin and Eosin Staining

The histological examination started with processing the paraffin blocks by dehydrating with alcohol concentration 70% to 100% for 60 min each. This was followed by 3 clarifications of xylene, for 15 min each time. After that, in an incubator at 60 °C, the permeation treatment with paraffin solution was carried out three times for 60 min each. The tissue was then immersed in liquid paraffin and brought to room temperature. Each paraffin block was then cut to a thickness of 4–6 m using a microtome. Cell morphology was determined with *hematoxylin* and *eosin*. The slides were dipped in xylene three times for 5 min each and hydrated with alcohol (96% to 70% alcohol) for 2 min each. The slides were then rinsed under running water for 10 min, placed in *Mayer's hematoxylin* for 15 min, rinsed with running water and examined microscopically. The slides were then placed in 1% eosin solution for 30 s, dried, washed, and mounted with an EZ mount. This was performed on five visual fields, with 400× magnification around the defect or implant area. The results obtained are the number of each bone cell, including osteoblasts, osteoclasts and osteocytes.

2.9. Immunohistochemistry

The immunohistochemical technique was used to stain VEGF and osteocalcin immunopositive cells. Slides that have been paraffinized are soaked with an antigen retrieval decloaking chamber, cooled for 20 min, and washed with PBS for 3 min. Sniper blocking followed for 15 min. The slides were then incubated with rabbit anti-rat VEGF primer (cat. no. PA1-21796, Thermo Fisher Scientific, 1:100 dilution) (Waltham, Massachusetts, United States) and washed in PBS for 3 min. After that, the universal link was performed for 20 min, and the slide was washed in PBS for 3 min. The Trecavidin-HRP Label was then applied for 10 min and washed with PBS for 3 min. The slides were then reacted with Chromogen DAB + Buffer Substrate for 2–5 min, followed by rinsing for 5 min with running water. The slides were then stained with *hematoxylin* for 1–2 min followed by rinsing for 5 min with running water (twice). The slides were then dehydrated with alcohol (70% absolute alcohol) for 5 min each, followed by three xylol washes for 5 min each. Finally, they were mounted on a slide (Ecomount) and covered with a cover glass.

2.10. Bone Alkaline Phosphatase

Examination of BALP levels was carried out using the Rabbit Bone-Specific Alkaline Phosphatase ELISA Kit (Cat. No. BZ-08173140-EB) (Bioenzy, Jakarta, Indonesia) with the following steps: prepare all reagents, standard solutions and samples; bring all reagents to room temperature before use. Add 50 µL standard to standard well; add 40 µL sample to sample wells and add 10 µL anti-BAP antibody to sample wells; then add 50 µL streptavidin-HRP to sample wells and standard wells (not blank control well) and mix well. Cover the plate with a sealer. Incubate for 60 min at 37 °C. After that, remove the sealer and wash the plate 5 times with a wash buffer. Soak wells with at least 0.35 mL wash buffer for 30 s to 1 min for each wash. Blot the plate onto paper towels or other absorbent material. Then, add 50 µL substrate solution A to each well and then add 50 µL substrate solution B to each well. Incubate plate covered with a new sealer for 10 min at 37 °C in the dark. Add 50 µL Stop Solution to each well, and the blue color will change into yellow immediately. Determine the optical density (OD value) of each well immediately, using a microplate reader set to 450 nm within 10 min after adding the stop solution.

2.11. Calcium Concentration

Examination of calcium levels in the blood is carried out using the Calcium Colorimetric Assay Kit (Cat. No. MAK022) (Sigma-aldrich, St. Louis, MO, USA). Serum samples can be used directly in this assay. Add 90 mL of the Chromogenic Reagent (Sigma-aldrich, St. Louis, MO, USA) to each well containing standards, samples, or controls and mix gently. Then, add 60 mL of Calcium Assay Buffer (Sigma-aldrich, St. Louis, MO, USA) to each well and mix gently. After that, incubate the reaction for 5–10 min at room temperature.

Protect the plate from light during incubation. Measure the absorbance at 575 nm (A575) before assay.

2.12. Statistical Analysis

Evaluation of the size of the bone gap that was closed radiologically was analyzed used the Shapiro–Wilk test to determine the normality of the data and homogeneity test using the Levene test. If the data is normally distributed, then the one-way ANOVA test is continued. If the results show a difference in meaning, then it is continued with the LSD post hoc test. Meanwhile, if the data is not normally distributed; then, the Kruskal–Wallis test is carried out and then the Mann–Whitney test. This also applies to the evaluation of number of osteoblasts, osteocytes, and osteoclasts by HE staining, BALP and calcium levels in the blood. The evaluation percentage of callus growth around bone defects was assessed by means of Lane–Sandhu scoring. Evaluation of VEGF and osteocalcin expression using immunohistochemistry was performed semi-quantitatively via the Remmele method. The three tests were analyzed using the Kruskal–Wallis test, and assessment was continued with the Mann–Whitney test if there were significant differences between groups.

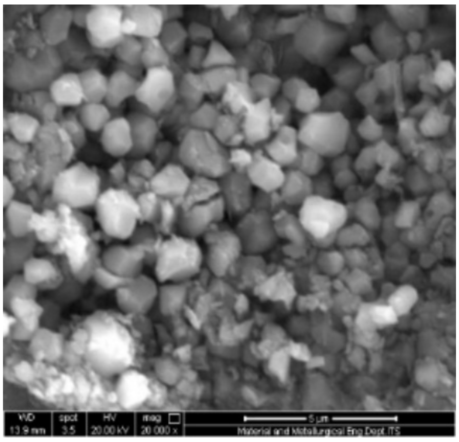
3. Results

3.1. Characterizations of Pellet

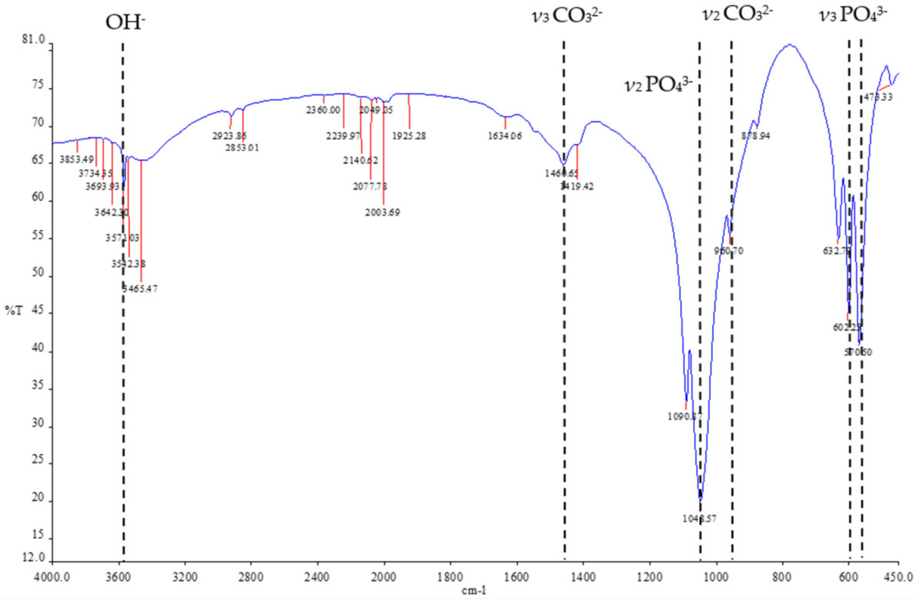
The results of the SEM identification show that the resulting pellet has a hexagonal particle shape with a particle size mean of 1.350 ± 0.243 µm (Mean ± SD) (Figure 1a). The results of the FT-IR from BHA describe the percentage of transmission at the specific wave numbers PO_4 = 1048.57 cm^{-1}, OH = 3571.03 cm^{-1}, and CO_3 = 1460.65 cm^{-1}, which are the harsh characteristics of bovine hydroxyapatite. Meanwhile, the result of the assessment in gelatin describe the emergence of the percentage of transmission in OH; NH_2; = 3500–3000 cm^{-1}; C=O and NH = 1655–1540 cm^{-1}; COO = 1450–1240 cm^{-1} (Figure 1b–d).

3.2. Radiology Examination

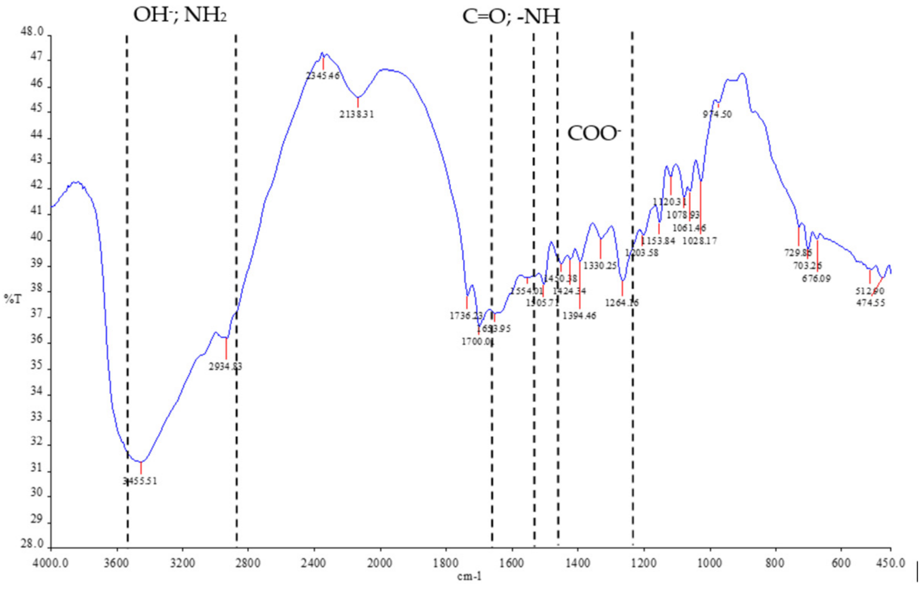
A study on the effect of oral BHA or calcium lactate on the repair of bone defects, implanted with BHA–GEL pellets, was carried out using a burr hole defect model in the cortical bone of the rabbit femur. Defects with implants appear circular, with higher intensity than their surroundings. The radiographic results showed that the implant group experienced accelerated bone growth in the area of the defect compared to the group without implants. The pellet intensity in the implant + oral BHA group was known to be fainter than that in the implant + oral calcium lactate group (Figure 2a,b), indicating the union of bone with the composite. The results of the evaluation of bone gap closure-obtained data that were not normally distributed ($p < 0.05$) nor homogeneous ($p < 0.05$) in the termination group on days 7, 14 and 28. Furthermore, using the Kruskal–Wallis, it was found that there was no difference which was significant ($p > 0.05$) between groups for each termination period (Figure 2c). The development of bone regeneration can also be known based on callus formation, which is characterized by changes in the intensity and transformation of the implants implanted. The longer treatment times showed the intensity of the pellets was fading, but the radiological results did not describe the percentage of callus growth so that it was continued with macroscopic observations. Lane–Sandhu scoring results (macroscopic observation) showed that the longer the treatment time, the higher the percentage of callus growth. The data generated from the scoring process includes non-parametric data so that the test carried out is Kruskal–Wallis and shows a sig. value ($p > 0.05$), or there is no significant difference between groups in each termination period (Figure 2d).



(**a**)

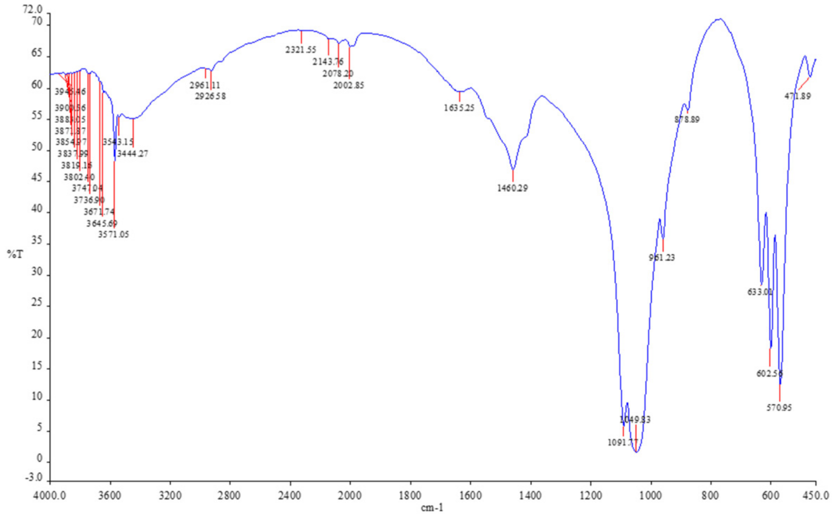


(**b**)



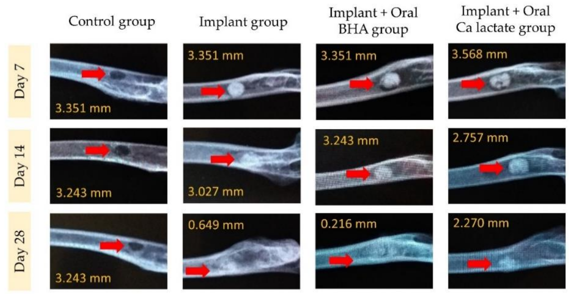
(**c**)

Figure 1. *Cont.*

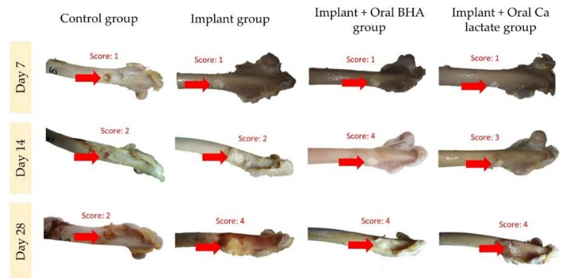


(**d**)

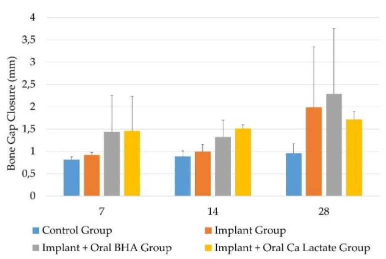
Figure 1. (**a**) Representative of SEM Scanning Result of BHA–GEL Pellet; (**b**) FT-IR Spectra Profile of BHA (**c**) FT-IR Sepctra Profile of Gelatin; (**d**) FT-IR Spectra Profile of BHA–GEL Pellet.



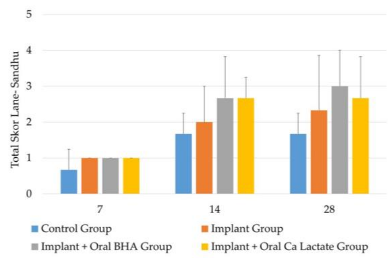
(**a**)



(**b**)



(**c**)

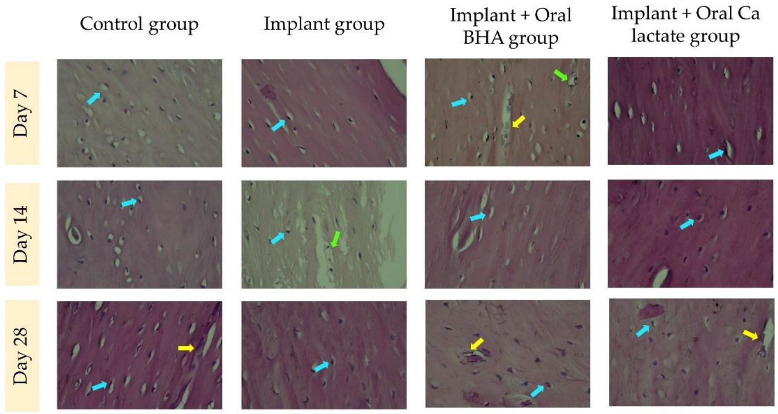


(**d**)

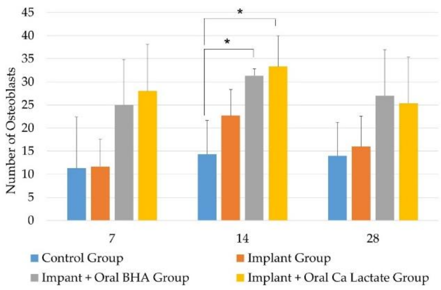
Figure 2. (**a**) X-ray radiology results of rabbit femur (1024 × 1024 pixel); (**b**) rabbit femur bone macroscopic; (**c**) result of measurement of bone cleft closure; (**d**) calculation results with Lane–Sandhu Scoring. The red arrow in subfigures (**a**,**b**) indicates the location of the defect. The implanted group showed accelerated bone growth in the defect area.

3.3. Examination of the number of Osteoblasts, Osteoclasts and Osteocytes through Hematoxylin-Eosin Staining

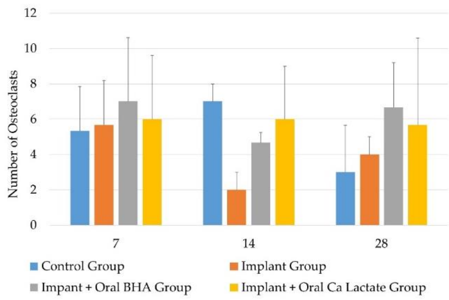
The data from the observation of osteoblast cells (Figure 3a) obtained showed that the data were normally distributed ($p > 0.05$) and homogeneous ($p > 0.05$) for each termination period. On days 7 and 28, there was no significant difference (one-way ANOVA; $p > 0.05$) between groups. Meanwhile, on the 14th day, it was known that the implant + oral BHA and implant + oral calcium lactate groups were significantly different (one-way ANOVA post hoc LSD; $p < 0.05$) compared to the defect group (control) (Figure 3b).



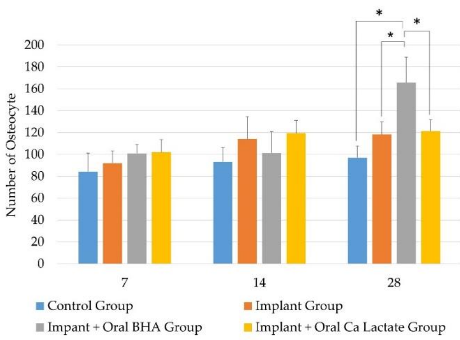
(**a**)



(**b**)



(**c**)



(**d**)

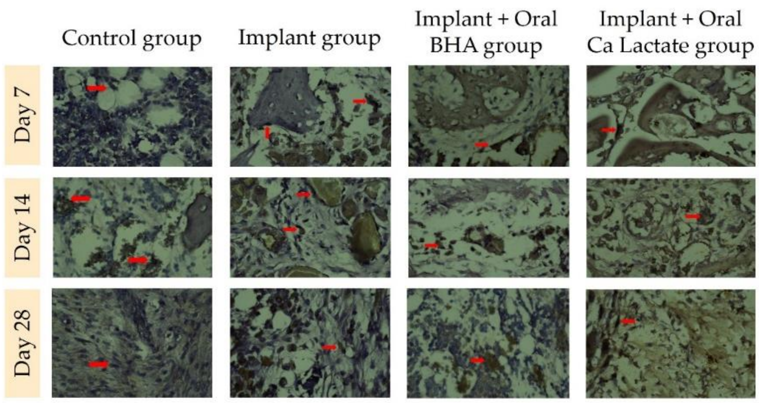
Figure 3. (**a**) Observation of bone cells with *Hematoxylin-Eosin* staining, magnification 400×. Osteoblast (yellow arrows), osteoclast (green arrows), and osteocyte (blue arrows); (**b**) observation of the number of osteoblast cells; (**c**) observation of the number of osteoclast cells; (**d**) observation of the number of osteocyte cells. The sign (*) indicates $p < 0.05$ with one-way ANOVA post hoc LSD test.

The data from the observation of osteoclast cells (Figure 3a) on days 7 and 28 were normally distributed ($p > 0.05$) and homogeneous ($p > 0.05$), and there was no significant difference (one-way ANOVA; $p > 0.05$) between groups. On day 14 the data were not normally distributed ($p < 0.05$) and there was no significant difference (Kruskal–Wallis; $p > 0.05$) between groups (Figure 3c).

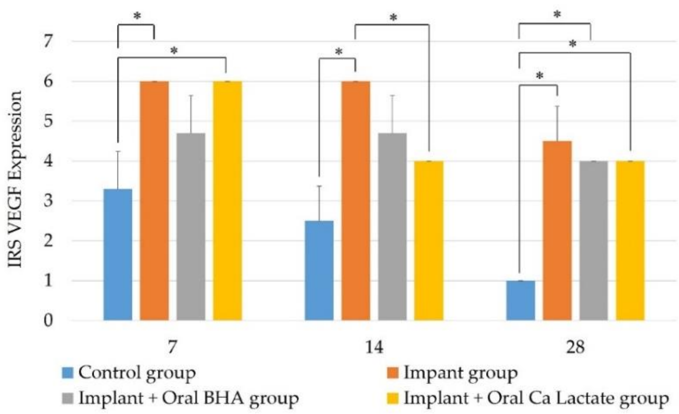
The data from the observation of osteocyte cells (Figure 3a) obtained data that were normally distributed ($p > 0.05$) and homogeneous ($p > 0.05$) for each termination period. On days 7 and 14 there was no significant difference (one-way ANOVA; $p > 0.05$) between groups. Meanwhile, on day 28, it was found that the implant + oral BHA group was significantly different from the defect group (control), the implant group and the implant + oral calcium lactate group (one-way ANOVA post hoc LSD; $p < 0.05$). This indicates the effect of the addition of oral BHA on the number of osteocyte cells (Figure 3d).

3.4. Examination of the Amount and Distribution of VEGF through Immunohistochemistry

Immunohistochemical examination with anti-VEGF was performed to determine the vascularity of bone tissue in each treatment group. The results of the observation of VEGF expression using the Kruskal–Wallis test analysis in the negative control group, the implant group, the implant + oral BHA group, and the implant + oral calcium lactate group at 7, 14, and 28 days (Figure 4b) showed different values. VEGF expression was calculated ($p < 0.05$). When the results of VEGF expression in the implant and oral BHA group and the implant and oral calcium lactate group on days 7, 14, and 28, there was no difference in VEGF expression value ($p > 0.05$) with the Mann–Whitney test.



(**a**)

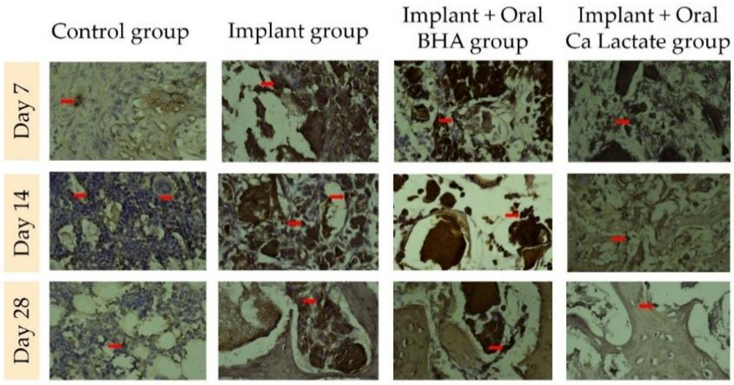


(**b**)

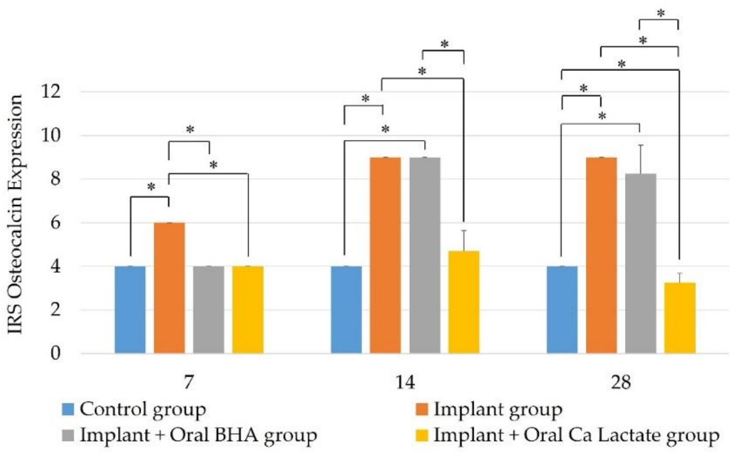
Figure 4. (**a**) Immunohistochemistry of VEGF expression (400× magnification). VEGF-positive cells are indicated by brown osteoblasts (red arrows); (**b**) differences in IRS values of VEGF expression, each bar graph represents IRS ± SD. The sign (*) indicates $p < 0.05$ with the Mann–Whitney Test.

3.5. Examination of the Amount and Distribution of Osteocalcin through Immunohistochemistry

Immuno-histochemical examination with anti-osteocalcin was performed to determine the number of osteoblasts which are markers of mineral deposition and growth of mature callus in each treatment group. The results of observations of osteocalcin expression in the negative control group, implant group, implant + oral BHA group, and implant + oral calcium lactate group at 7, 14, and 28 days (Figure 5b) showed differences in the value of osteocalcin expression ($p < 0.05$) with the Kruskal–Wallis test. On days 14 and 28, the implant + oral BHA group showed higher IRS scores than the implant + calcium lactate group (Mann–Whitney; $p < 0.05$).



(**a**)

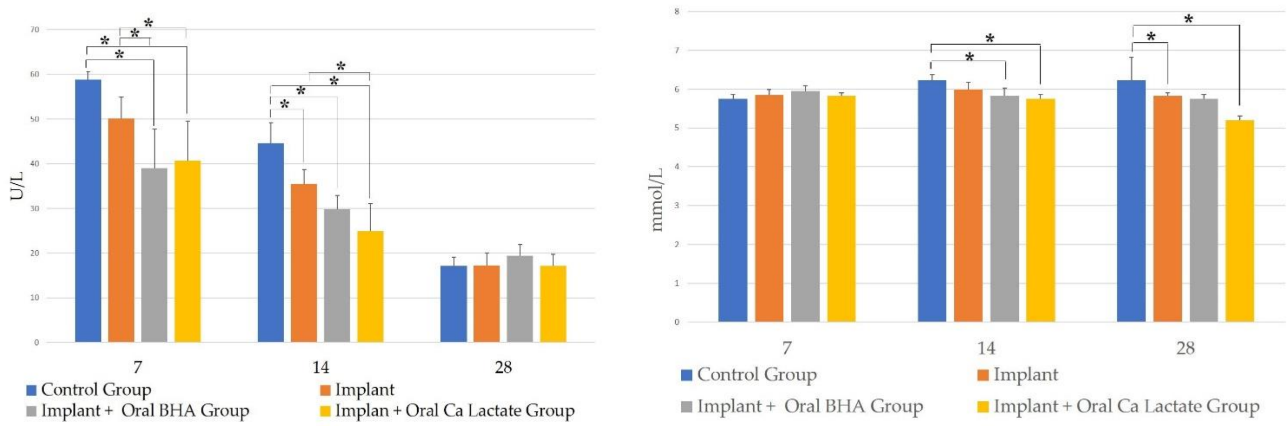


(**b**)

Figure 5. (**a**) Immunohistochemistry of osteocalcin expression (400× magnification). Osteocalcin-positive cells are indicated by brown osteoblasts (red arrows); (**b**) differences in IRS values of osteocalcin expression, each bar graph representing IRS ± SD. The sign (*) indicates $p < 0.05$ with the Mann–Whitney Test.

3.6. Examination of BALP Levels through ELISA

The results of measurements of BALP levels obtained data that were normally distributed ($p > 0.05$) and homogeneous ($p > 0.05$). There was a significant difference between the implant + oral BHA group and the implant + oral calcium lactate compared to the defect and implant groups on day 7. Meanwhile, on day 14, there was a significant difference between the defect group with an implant, an implant + oral BHA, and an implant + oral calcium lactate (One-way ANOVA post hoc LSD; $p < 0.05$) (Figure 6a).



(**a**) (**b**)

Figure 6. (**a**) BALP level examination results; (**b**) results of examination of calcium levels sign (*) indicates $p < 0.05$ in post hoc LSD test.

3.7. Examination of Calcium Levels in the Blood through the Calcium Colorimetric Assay Kit

The results of the measurement of calcium levels in the blood obtained data that were normally distributed ($p > 0.05$) and homogeneous ($p > 0.05$). There was a significant difference between the defect group with implant + oral BHA, implant + oral calcium lactate on day 14. Meanwhile, on day 28 there was a difference between the defect group with implant and implant + oral calcium lactate (one-way ANOVA post hoc LSD; $p < 0.05$) (Figure 6b).

4. Discussion

An in vivo study to test the effectiveness of oral BHA and calcium lactate in conjunction with BHA–GEL implants was performed on femoral bone defects in rabbits. Based on previous studies, BHA–GEL implants showed accelerated bone growth in terms of the percentage of new bone and bone-composite contact [10]. Castelo et al. [28] stated that the ossein hydroxyapatite complex (OHC) consisting of ossein, a protein that forms the organic matrix of bone and hydroxyapatite ($Ca_5[PO_4]_3OH$) has been shown to be effective in maintaining bone mineral density (BMD) and has a strong osteogenic effect which is stronger than calcium supplements. Other studies have shown that OHC stimulates bone metabolism by stimulating osteoblast differentiation, activity, and proliferation [29]. OHC has been shown to reduce the rate of bone resorption and stimulate ossification. Administration of OHC as monotherapy for 1–4 weeks in fracture patients has shown a reduction in the time required for healing by stimulating callus formation, thereby accelerating consolidation and clinical improvement [30].

From the characterizations of the pellet, the morphological shape of the particle was hexagonal, with a particle size mean of 1.350 ± 0.243 µm (mean ± SD). This is in line with previous studies of natural hydroxyapatite, one of which shows BHA possess a hexagonal particle shape [31,32]. Several factors that can influence the morphology of the particles are changes in the calcination temperature, as described by Khoo et al. [33]. Then, the FTIR spectra showed the specific wave number of functional group of the structure as well as the BHA–GEL pellet. The band at 1048 cm^{-1} is attributed to an asymmetric stretching vibration mode ν_3 of PO_4^{3-}, while two sharp peaks at 570 nd 602 cm^{-1} are attributed to asymmetric bending vibration mode ν_3, and symmetric bending vibration mode ν_2 of PO_4^{3-} group. The bands observed at 962 and 1458 cm^{-1} at the FTIR spectra indicate the presence of B-type carbonate CO_3^{2-} bands [34].

Radiological results revealed the development of bone growth; after measuring bone gap closure, it was found that the implant + oral BHA group (the average diameter on day 28 is 1.910 mm) had a smaller final diameter of the bone gap than the implant + oral calcium lactate group (the average diameter on day 28 is 2.487 mm). This is supported by the observation of callus growth in bone defects, where changes in transformation and pellet intensity were more faded in the implant + oral BHA group. This indicated the growth of new tissue that was fused (union) with the bone due to the penetration of tissue cells around the bone into the implant.

The reparative process of bone fractures involves a series of events that include migration, proliferation, differentiation and activation of several cell types. These include mesenchymal and hematopoietic stem cells that ultimately lead to bone formation and remodeling [35]. These stem cells will differentiate into several types of bone cells, including osteoblasts and osteoclasts, while osteocytes are transformed osteoblasts that are embedded in the bone matrix. All three cells were expressed by *Hematoxylin-Eosin* staining. On day 14, it was found that the osteoblast cells in the implant + oral BHA group were significantly different from the defect group (control). In accordance with the previous theory, where BHA has a carbonate group which is known to increase the proliferation and differentiation of osteoblasts as well as mesenchymal stem cells which are osteoprogenitor cells that produce osteoblasts, thus bone matrix synthesis occurs more quickly [36]. Furthermore, there was also a significant difference between the implant + oral calcium lactate group and the defect group (control). In previous studies, it was stated that calcium lactate can increase extracellular calcium and intracellular calcium levels, thereby stimulating bone formation significantly, as well as increasing osteoblast proliferation or chemotaxis [22]. The same thing was observed in the observation of the number of osteocytes, where an increase in osteoblast proliferation would result in more mineralized osteoid so that the number of osteocytes also increased.

Osteoclasts on day 14 of the defect group (control) increased, indicating that the activity of mature osteoclasts was maximal in resorption of bone in the second week. However, in the group with the implant, the number of osteoclasts was lower than in the defect group (control). This may have been because the group with the implant treatment or the addition of calcium supplements had accelerated fracture healing. Substitution of carbonate contained in BHA causes bioresorption to occur earlier [37]. Increased osteoclastogenesis accelerates cartilage resorption and increased osteoblastogenesis during fracture healing promotes bone fusion, whereas inhibition of osteoclast or osteoblast differentiation has been reported to delay bone healing [38]. The processes of resorption by osteoclasts and bone formation by osteoblasts proceed sequentially but overlap substantially, so that there is a change in the cell population that indicates regeneration in the tissue [2]. This can be seen through the results of research where when there is an increase in the number of osteoblasts, the number of osteoclasts decreases, or vice versa.

Parameters measured by the IHC method were vascular endothelial growth factor (VEGF) and osteocalcin. VEGF is a protein that plays an important role in endothelial proliferation, migration, and activation [39]. VEGF can be detected in the first week after injury, namely in the inflammatory phase [40]. The results of the examination of VEGF expression in the implant + oral BHA group compared to the implant + oral calcium lactate group on days 7, 14, and 28 showed no significant difference. This is probably because VEGF expression in the implant + oral BHA group was seen on day 3, and then peaked on day 5 [41]. In the implant + oral BHA group, there may have been a decrease in the number of macrophages, so that VEGF expression decreased. This decrease was influenced by a decrease in the number of blood vessels damaged in the wound; the extracellular matrix begins to fill the missing area and stable blood vessels begin to form [42]. Based on this study, the implant + oral BHA group was found to be effective in increasing VEGF expression on day 14 compared to the implant + oral calcium lactate group based on the IRS value of VEGF expression.

Osteocalcin is a non-collagenous protein that has an important role in the mineralization process and calcium ion homeostasis [43,44]. The results of the examination of osteocalcin expression in this study were all groups experienced an increase in osteocalcin expression since day 14. This is in line with the research of Jafary et al. [45], which states that an increase in osteocalcin can be detected at week 2, which is day 14. Osteocalcin can be detected in mature callus [4]. Mature callus begins to form from the repair phase to the remodeling phase [20]. Osteoblast maturation was demonstrated by increasing the value of osteocalcin expression [43]. Osteocalcin plays an important role in regulating mineral nucleation by binding to hydroxyapatite. Based on the study, the value of osteocalcin expression on days 14 and 28 showed a higher value of osteocalcin expression in the implant + oral BHA group than the implant + oral calcium lactate group. This is because BHA increases the proliferation of hydroxyapatite by stimulating mesenchymal cells, resulting in faster hard callus formation [18].

These results were also similar to the results of measuring BALP levels, where the group receiving oral BHA had higher BALP levels than the oral calcium lactate group. Bone alkaline phosphatase (BALP) is a metalloenzyme that is produced when osteoblast cells work [46]. High expression of BALP indicates better activity where BALP is useful in the synthesis of collagen fibers and in bone mineralization. On the 7th day, BALP levels were higher than the 14th and 28th days which could be due to the process of differentiation of osteoblasts. This is also in accordance with the theory which states that bone alkaline phosphatase (BALP) is a metalloenzyme that is produced when osteoblast cells work [46,47]. Osteoblasts will express collagen, which plays a role in the process of bone mineralization to a form soft callus. This is also in accordance with the statement of Einhorn and Gerstenfeld [2], and on the 7th day it enters the proliferative or endochondral phase where the soft callus begins to form. Soft callus growth also occurs because the gelatin contained in the implant is degraded to form type 1 collagen which is the main constituent of bone [8]. On the 14th day BALP levels decreased compared to the 7th day; this is because at this stage the process of fibrous tissue formation has occurred and soft callus maturation has begun, which has occurred on the 7th day [2]. On day 14, the mean number of osteoblasts also decreased as, according to the matrix maturation phase, osteoblasts lost their function and differentiated into osteoid in the bone [48]. On day 28, BALP also decreased, which could be due to the near-complete fracture healing process [49]. Birmingham et al. [50] also stated that the differentiation of osteoblast cells occurred at the beginning of day 5 to 14, after which there was a decrease in BALP expression. In addition, the results of the examination of higher blood calcium levels in the implant + oral BHA group compared to the implant + oral calcium lactate group will also increase the proliferation and/or chemotaxis of osteoblasts, thereby stimulating bone formation significantly.

Calcium lactate is known to be highly soluble and has high bioavailability; however, hydroxyapatite, which is generally considered insoluble, shows absorption values one-fourth to one-third as good as the most soluble preparations [51]. Hydroxyapatite raises blood calcium levels less than calcium carbonate and calcium citrate. This indicates that hydroxyapatite is more effective in entering bone cells [18]. In addition, in vitro examination of bone cell cultures showed that the organic part of OHC contains factors that influence osteoblast proliferation [13]. This causes the bone growth of the implant + oral BHA group to be better than the implant + oral calcium lactate group. BHA also has a carbonate group that is naturally present in human bone and that can be found in synthetic biomimetic hydroxyapatites. Carbonated hydroxyapatite is known to increase protein adsorption and increase adhesion, proliferation, and osteogenic differentiation of mesenchymal stem cell tissue. In addition, carbonated hydroxyapatite is also known to increase the proliferation and differentiation of osteoblasts, thereby increasing bone matrix synthesis [36]. The same thing happened in the study by Castelo et al. [29], based on histological observations of bone using a fluorescent microscope showed that oral administration of ossein hydroxyapatite could increase bone formation compared to the group given hydroxyapatite alone or with calcium carbonate. In addition, this is influenced by the absorption to the bioavailability of the two supplements given. It is known that the absorption of microcrystalline hydroxyapatite compound (MCHC) is about 42.5% [19], and it is higher than the absorption of calcium lactate which is around 25% [24].The results showed that the bioavailability of calcium lactate in rats was 8.9 + 1.4% [52]. Meanwhile, hydroxyapatite is reported to have better bioavailability than calcium carbonate [14], and as good as or better than calcium gluconate [53].

5. Conclusions

BHA supplements, given orally together with BHA–GEL pellet implants, showed faster healing of bone defects compared to oral calcium lactate with BHA–GEL pellet implants.

Author Contributions: Conceptualization, A.S.B., J.K. and S.S.; Data curation, C.A. and I.S.; Formal analysis, S.S., M.A.G. and I.S.; Investigation, B.R.K.H.P., H.A., R.N.S. and I.L.; Methodology, A.S.B. and J.K.; Project administration, A.S.B. and M.A.G.; Resources, S.S., M.A.G. and E.R.; Supervision, A.S.B., J.K. and C.A.; Validation, S.S., C.A., M.A.G. and E.R.; Visualization, B.R.K.H.P., H.A., R.N.S., I.L. and Y.A.P.; Writing—original draft, B.R.K.H.P., H.A., R.N.S., I.L. and Y.A.P.; Writing—review & editing, A.S.B., J.K. and C.A. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by Lembaga Pengelola Dana Pendidikan Ministry of Finance of the Republic of Indonesia via Pendanaan Riset Inovatif Produktif (RISPRO) Batch 1 Tahun 2019 No. KEP-51/LPDP/2019.

Institutional Review Board Statement: The animal study protocol was approved by the Institutional Review Board (or Ethics Committee) of Faculty of Veterinary Medicine, Universitas Airlangga (Animal Care and Committee/ACUC) (protocol code No. 2.KEH.075.05.2022 by 5 May 2022).

Data Availability Statement: Not applicable.

Acknowledgments: The authors thank to the Lembaga Pengelola Dana Pendidikan Ministry of Finance of the Republic of Indonesia, BPBRIN Universitas Airlangga, PT. INOBI Indonesia, and Faculty of Pharmacy Universitas Airlangga.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Barrett, K.E.; Barman, S.M.; Boitano, S.; Brooks, H. *Ganong's Review of Medical Physiology*; McGraw-Hill Education: New York City, NY, USA, 2012; 768p.
2. Einhorn, T.A.; Gerstenfeld, L.C. Fracture Healing: Mechanisms and Interventions. *Nat. Rev. Rheumatol.* **2015**, *11*, 45–54. [CrossRef] [PubMed]
3. Noorisa, R.; Apriliwati, D.; Aziz, A.; Bayusentono, S. The Characteristic of Patients With Femoral Fracture In Department Of Orthopaedic And Traumatology RSUD Dr. Soetomo Surabaya 2013–2016. *J. Orthop. Traumatol. Surabaya* **2017**, *6*, 1–11. [CrossRef]
4. Ferdiansyah Mahyudin, N. *Graft Tulang & Material Pengganti Tulang (Karaktersitik Dan Strategi Aplikasi Klinis)*; Airlangga University Press: Surabaya, Indonesia, 2018.
5. Budiatin, A.S.; Zainuddin, M.; Khotib, J.; Ferdiansyah. Pelepasan Gentamisin Dari Pelet Bovine-Hydroxyapatite-Gelatin Sebagai Ssitem Penghantaran Obat Dan Pengisi Tulang. *J. Farm. Dan Ilmu Kefarmasian Indones.* **2014**, *1*, 10–15.
6. Ardhiyanto, H. Peran Hidroksiapatit Sebagai Material Bone Graft Dalam Menstimulasi Kepadatan Kolagen Tipe L Pada Proses Penyembuhan Tulang. *Stomatognatic-J. Kedokt. Gigi* **2015**, *9*, 16–18.
7. Marfil, P.H.M.; Anhê, A.C.B.M.; Telis, V. Texture and Microstructure of Gelatin/Corn Starch-Based Gummy Confections. *Food Biophys.* **2012**, *7*, 236–243. [CrossRef]
8. Budiatin, A.S.; ZAINUDDIN, M.; KHOTIB, J. Biocompatible Composite as Gentamicin Delivery System for Osteomyelitis and Bone Regeneration. *Int. J. Pharm. Pharm. Sci.* **2014**, *6*, 4.
9. Chao, W.W.; Lin, B.F. Isolation and Identification of Bioactive Compounds in Andrographis Paniculata (Chuanxinlian). *Chin. Med.* **2010**, *5*, 17. [CrossRef]
10. Gani, M.A. *Studi Komparasi Osteokonduktivitas Natural Dan Synthetic Hydroxyapatite Serta Keterlibatan Polaritas Makrofag Pada Defek Tulang*; Universitas Airlangga: Surabaya, Indonesia, 2021.
11. Khotib, J.; Lasandara, C.S.; Samirah, S.; Budiatin, A.S. Acceleration of Bone Fracture Healing through the Use of Natural Bovine Hydroxyapatite Implant on Bone Defect Animal Model. *Folia Med. Indones.* **2019**, *55*, 176. [CrossRef]
12. Mandagi, C.A.F.; Bidjuni, H.; Hamel, R.S. Karakteristik Yang Berhubungan Dengan Tingkat Nyeri Pada Pasien Fraktur Di Ruang Bedah Rumah Sakit Umum Gmim Bethesda Tomohon. *J. Keperawatan.* **2017**, *5*, 1–7.
13. Schmidt, K.H.; Wörner, U.M.; Buck, H.J. Examination of New Bone Growth on Aluminium Oxide Implant Contact Surfaces after Oral Administration of Ossein-Hydroxyapatite Compound to Rats. *Curr. Med. Res. Opin.* **1988**, *11*, 107–115. [CrossRef]
14. Straub, D.A. Calcium Supplementation in Clinical Practice: A Review of Forms, Doses, and Indications. *Nutr. Clin. Pract.* **2007**, *22*, 286–296. [CrossRef]
15. Wang, Y.; Von Euw, S.; Fernandes, F.M.; Cassaignon, S.; Selmane, M.; Laurent, G.; Pehau-Arnaudet, G.; Coelho, C.; Bonhomme-Coury, L.; Giraud-Guille, M.M.; et al. Water-Mediated Structuring of Bone Apatite. *Nat. Mater.* **2013**, *12*, 1144–1153. [CrossRef]

16. Olivier, F.; Rochet, N.; Delpeux-Ouldriane, S.; Chancolon, J.; Sarou-Kanian, V.; Fayon, F.; Bonnamy, S. Strontium Incorporation into Biomimetic Carbonated Calcium-Deficient Hydroxyapatite Coated Carbon Cloth: Biocompatibility with Human Primary Osteoblasts. *Mater. Sci. Eng. C* **2020**, *116*, 111192. [CrossRef] [PubMed]
17. Germaini, M.M.; Detsch, R.; Grünewald, A.; Magnaudeix, A.; Lalloue, F.; Boccaccini, A.R.; Champion, E. Osteoblast and Osteoclast Responses to Porous A/B Carbonate-Substituted Hydroxyapatite Ceramics for Bone Regeneration. *Biomed. Mater.* **2017**, *12*, 035008. [CrossRef] [PubMed]
18. Bristow, S.M.; Gamble, G.D.; Stewart, A.; Horne, L.; House, M.E.; Aati, O.; Mihov, B.; Horne, A.M.; Reid, I.R. Acute and 3-Month Effects of Microcrystalline Hydroxyapatite, Calcium Citrate and Calcium Carbonate on Serum Calcium and Markers of Bone Turnover: A Randomised Controlled Trial in Postmenopausal Women. *Br. J. Nutr.* **2014**, *112*, 1611–1620. [CrossRef] [PubMed]
19. Stellon, A.; Davies, A.; Webb, A.; Williams, R. Microcrystalline Hydroxyapatite Compound in Prevention of Bone Loss in Corticosteroid-Treated Patients with Chronic Active Hepatitis. *Postgrad. Med. J.* **1985**, *61*, 791–796. [CrossRef]
20. Adrianto, H.B. Peran Hidroksiapatit Sebagai Bone Graft Dalam Proses Penyembuhan Tulang. *Stomatognatic-J. Kedokt. Gigi* **2011**, *8*, 118–121.
21. Sweetman, S.C. *Martindale*; Pharmaceutical Press: London, UK, 2009.
22. Muliani, I.; Nyoman, M.K.; Ketut, T. Pemberian Kalsium Laktat Dan Berenang Meningkatkan Osteoblast Pada Epiphysis Tulang Radius Mencit Perimenopause. *J. Vet.* **2014**, *15*, 39–45.
23. Wagner, G.; Kindrick, S.; Hertzler, S.; DiSilvestro, R.A. Effects of Various Forms of Calcium on Body Weight and Bone Turnover Markers in Women Participating in a Weight Loss Program. *J. Am. Coll. Nutr.* **2007**, *26*, 456–461. [CrossRef]
24. Szterner, P.; Biernat, M. The Synthesis of Hydroxyapatite by Hydrothermal Process with Calcium Lactate Pentahydrate: The Effect of Reagent Concentrations, PH, Temperature, and Pressure. *Bioinorg. Chem. Appl.* **2022**, *2022*, 3481677. [CrossRef]
25. Gaby, K. Bioavailability and Solubility of Different Calcium-Salts as a Basis for Calcium Enrichment of Beverages. *Food Nutr. Sci.* **2010**, *2010*, 3035.
26. Khotib, J.; Gani, M.A.; Budiatin, A.S.; Lestari, M.L.A.D.; Rahadiansyah, E.; Ardianto, C. Signaling Pathway and Transcriptional Regulation in Osteoblasts during Bone Healing: Direct Involvement of Hydroxyapatite as a Biomaterial. *Pharmaceuticals* **2021**, *14*, 615. [CrossRef] [PubMed]
27. Wölfl, C.; Schweppenhäuser, D.; Gühring, T.; Takur, C.; Höner, B.; Kneser, U.; Grützner, P.A.; Kolios, L. Characteristics of Bone Turnover in the Long Bone Metaphysis Fractured Patients with Normal or Low Bone Mineral Density (BMD). *PLoS ONE* **2014**, *9*, e96058. [CrossRef]
28. Castelo-Branco, C.; Cancelo Hidalgo, M.J.; Palacios, S.; Ciria-Recasens, M.; Fernández-Pareja, A.; Carbonell-Abella, C.; Manasanch, J.; Haya-Palazuelos, J. Efficacy and Safety of Ossein-Hydroxyapatite Complex versus Calcium Carbonate to Prevent Bone Loss. *Climacteric* **2020**, *23*, 252–258. [CrossRef] [PubMed]
29. Castelo-Branco, C.; Ciria-Recasens, M.; Cancelo-Hidalgo, M.J.; Palacios, S.; Haya-Palazuelos, J.; Carbonell-Abelló, J.; Blanch-Rubió, J.; Martinez-Zapata, M.J.; Manasanch, J.; Pérez-Edo, L. Efficacy of Ossein-Hydroxyapatite Complex Compared with Calcium Carbonate to Prevent Bone Loss: A Meta-Analysis. *Menopause* **2009**, *16*, 984–991. [CrossRef] [PubMed]
30. Castelo-Branco, C.; Dávila Guardia, J. Use of Ossein—Hydroxyapatite Complex in the Prevention of Bone Loss: A Review. *Climacteric* **2015**, *18*, 29–37. [CrossRef]
31. Costescu, A.; Pasuk, I.; Ungureanu, F.; Dinischiotu, A.; Costache, M.; Huneau, F.; Galaup, S.; le Coustumer, P.; Predoi, D. Physico-Chemical Properties Of Nano-Sized Hexagonal Hydroxyapatite Powder Synthesized By Sol-Gel. *Dig. J. Nanomater. Biostructures.* **2010**, *5*, 989–1000.
32. Budiatin, A.S.; Samirah; Gani, M.A.; Nilamsari, W.P.; Ardianto, C. The Characterization of Bovine Bone-Derived Hydroxyapatite Isolated Using Novel Non-Hazardous Method. *J. Biomim. Biomater. Biomed. Eng.* **2020**, *45*, 49–56. [CrossRef]
33. Khoo, W.; Nor, F.M.; Ardhyananta, H.; Kurniawan, D. Preparation of Natural Hydroxyapatite from Bovine Femur Bones Using Calcination at Various Temperatures. *Procedia Manuf.* **2015**, *2*, 196–201. [CrossRef]
34. Brahimi, S.; Ressler, A.; Boumchedda, K.; Hamidouche, M.; Kenzour, A.; Djafar, R.; Antunović, M.; Bauer, L.; Hvizdoš, P.; Ivanković, H. Preparation and Characterization of Biocomposites Based on Chitosan and Biomimetic Hydroxyapatite Derived from Natural Phosphate Rocks. *Mater. Chem. Phys.* **2022**, *276*, 125421. [CrossRef]
35. Abdelmagid, S.; Barbe, M.; Hadjiargyrou, M.; Owen, T.; Razmpour, R.; Rehman, S.; Popoff, S.; Safadi, F. Temporal and Spatial Expression of Osteoactivin During Fracture Repair. *J. Cell. Biochem.* **2010**, *111*, 295–309. [CrossRef] [PubMed]
36. Budiatin, A.S.; Gani, M.A.; Samirah; Ardianto, C.; Raharjanti, A.M.; Septiani, I.; Putri, N.P.K.P.; Khotib, J. Bovine Hydroxyapatite-Based Bone Scaffold with Gentamicin Accelerates Vascularization and Remodeling of Bone Defect. *Int. J. Biomater.* **2021**, *2021*, 5560891. [CrossRef]
37. Shi, P.; Liu, M.; Fan, F.; Yu, C.; Lu, W.; Du, M. Characterization of Natural Hydroxyapatite Originated from Fish Bone and Its Biocompatibility with Osteoblasts. *Mater. Sci. Eng. C.* **2018**, *90*, 706–712. [CrossRef]
38. He, L.H.; Liu, M.; He, Y.; Xiao, E.; Zhao, L.; Zhang, T.; Yang, H.Q.; Zhang, Y. TRPV1 Deletion Impaired Fracture Healing and Inhibited Osteoclast and Osteoblast Differentiation. *Sci. Rep.* **2017**, *7*, 42385. [CrossRef] [PubMed]
39. Hu, K.; Olsen, B.R. The Roles of Vascular Endothelial Growth Factor in Bone Repair and Regeneration. *Bone* **2016**, *91*, 30–38. [CrossRef] [PubMed]
40. Claes, L.; Recknagel, S.; Ignatius, A. Fracture Healing under Healthy and Inflammatory Conditions. *Nat. Rev. Rheumatol.* **2012**, *8*, 133–143. [CrossRef]

41. Li, B.; Wang, H.; Qiu, G.; Su, X.; Wu, Z. Synergistic Effects of Vascular Endothelial Growth Factor on Bone Morphogenetic Proteins Induced Bone Formation in Vivo: Influencing Factors and Future Research Directions. *BioMed Res. Int.* **2016**, *2016*, 2869572. [CrossRef]
42. Nofikasari, I.; Rufaida, A.; Aqmarina, C.D.; Failasofia, F.; Fauzia, A.R.; Handajani, J. Efek Aplikasi Topikal Gel Ekstrak Pandan Wangi Terhadap Penyembuhan Luka Gingiva. *Maj. Kedokt. Gigi Indones.* **2016**, *2*, 53–59. [CrossRef]
43. Li, J.; Zhang, H.; Yang, C.; Li, Y.; Dai, Z. An Overview of Osteocalcin Progress. *J. Bone Miner. Metab.* **2016**, *34*, 367–379. [CrossRef]
44. Hesaraki, S.; Nazarian, H.; Pourbaghi-Masouleh, M.; Borhan, S. Comparative Study of Mesenchymal Stem Cells Osteogenic Differentiation on Low-Temperature Biomineralized Nanocrystalline Carbonated Hydroxyapatite and Sintered Hydroxyapatite. *J. Biomed. Mater. Res.-Part B Appl. Biomater.* **2014**, *102*, 108–118. [CrossRef]
45. Jafary, F.; Hanachi, P.; Gorjipour, K. Osteoblast Differentiation on Collagen Scaffold with Immobilized Alkaline Phosphatase. *Int. J. Organ. Transplant. Med.* **2017**, *8*, 195. [PubMed]
46. Golub, E.E.; Boesze-Battaglia, K. The Role of Alkaline Phosphatase in Mineralization. *Curr. Opin. Orthop.* **2007**, *18*, 444–448. [CrossRef]
47. Greenblatt, M.B.; Tsai, J.N.; Wein, M.N. Bone Turnover Markers in the Diagnosis and Monitoring of Metabolic Bone Disease. *Clin. Chem.* **2017**, *63*, 464–474. [CrossRef]
48. Lorenzo, J.; Horowitz, M.; Choi, Y.; Takayanagi, H.; Schett, G. *Osteoimmunology: Interactions of the Immune and Skeletal Systems*; Academic Press: Cambridge, MA, USA, 2015.
49. Yudaniayanti, I.S. Aktifitas Alkaline Phosphatase Pada Proses Kesembuhan Patah Tulang Femur Dengan Terapi $CaCO_3$ Dosis Tinggi Pada Tikus Jantan (Sprague Dawley). *Media Kedokt. Hewan* **2005**, *21*, 15–18.
50. Birmingham, E.; Niebur, G.L.; McHugh, P.E. Osteogenic Differentiation of Mesenchymal Stem Cells Is Regulated by Osteocyte and Osteoblast Cells in a Simplified Bone Niche. *Eur. Cells Mater.* **2012**, *23*, 13–27. [CrossRef] [PubMed]
51. Heaney, R.P.; Recker, R.R.; Weaver, C.M. Absorbability of Calcium Sources: The Limited Role of Solubility. *Calcif. Tissue Int.* **1990**, *46*, 300–304. [CrossRef]
52. Ueda, Y.; Taira, Z. Effect of Anions or Foods on Absolute Bioavailability of Calcium from Calcium Salts in Mice by Pharmacokinetics. *J. Exp. Pharmacol.* **2013**, *5*, 65.
53. Buclin, T.; Jacquet, A.F.; Burckhardt, P. Intestinal Absorption of Calcium Gluconate and Oseine-Mineral Complex: An Evaluation by Conventional Analyses. *Schweiz. Med. Wochenschr.* **1986**, *116*, 1780–1783.

KEH FKH Unair

KOMISI ETIK HEWAN
FAKULTAS KEDOKTERAN HEWAN UNIVERSITAS AIRLANGGA
Animal Care and Use Committee (ACUC)

KETERANGAN KELAIKAN ETIK
“ ETHICAL CLEARENCE ”

No : 2.KEH.075.05.2022

KOMISI ETIK PENELITIAN (*ANIMAL CARE AND USE COMMITTEE*) FAKULTAS KEDOKTERAN HEWAN UNIVERSITAS AIRLANGGA SURABAYA, TELAH MEMPELAJARI SECARA SEKSAMA RANCANGAN PENELITIAN YANG DIUSULKAN, MAKA DENGAN INI MENYATAKAN BAHWA :

PENELITIAN BERJUDUL	: PENGARUH IMPLANT BONE GRAFTING BERBASIS BOVINE HYDROXYAPATITE - GELATIN PADA PERTUMBUHAN FRAKTUR TULANG
PENELITI UTAMA	: Samirah
UNIT/LEMBAGA/TEMPAT PENELITIAN	: Program Pendidikan Apoteker Fakutas Farmasi Universitas Airlangga
DINYATAKAN	: LAIK ETIK

Surabaya, 5 Mei 2022

Mengetahui
Dekan FKH-Unair,

Prof. Dr. Mirni Lamid, M.P.,Drh.
NIP. 196201161992032001

Ketua,

Dr. Nusdianto Triakoso, M.P.,Drh.
NIP. 196805051997021001

Polymers

COUNTRY

Switzerland

Universities and research institutions in Switzerland

Media Ranking in Switzerland

PUBLISHER

MDPI AG

H-INDEX

89

SUBJECT AREA AND CATEGORY

Chemistry
- Chemistry (miscellaneous)

Materials Science
- Polymers and Plastics

PUBLICATION TYPE	ISSN	COVERAGE	INFORMATION
Journals	20734360	1969, 2009-2021	Homepage How to publish in this journal alboeker@uni-potsdam.de

HONCERE TECHNOLOGY CO.LTD
HONCERE

SCOPE

-Polymer Synthesis: synthesis of copolymers, block-polymers, polyesters, elastomer, polyolefins, polyamides, polycarbonates, rubber, thermoplastics, thermosets, methods for polymerization, etc. -Polymer Analysis: characterization and analysis of polymers, polymeric materials and polymer additives, polymerization mechanism, measurement of molecular weight, size, conformation, structure, properties and behavior of polymers, separation, spectroscopy, and scattering techniques, structure-property-processing relationships. -Polymer Physics: crystallization, rheology, swelling, phase separation, viscosity and viscoelasticity, entanglements and crosslinking, mechanical properties, dielectric properties, optical properties, thermal properties, the kinetics of degradation and polymerization, polymers subjected to deformation, flow, and other external fields, polymers at interfaces and in confined spaces. -Polymer Theory and Simulation: numerical simulation for macromolecular systems towards the understanding of underlying physical or physico-chemical mechanisms, modeling of polymer structure and conformation, predictive algorithms of polymerization kinetics and polymerization mechanism, modeling and prediction of the performance of functional polymers, constitutive and multiscale modeling approaches for polymeric systems, kinetic theory of polymers, artificial intelligence, machine learning and data-driven modeling of polymers. -Polymer Processing and Performance: thermoforming, compression and transfer molding, rotational molding, extrusion, injection molding, blow molding, plastic foam molding. -Polymer Applications[...] -Biobased and Biodegradable Polymers[...] -Polymer Recycling[...] -Polymer Composites and Nanocomposites[...]

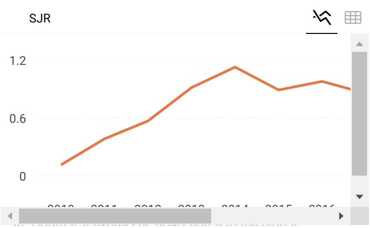
Join the conversation about this journal

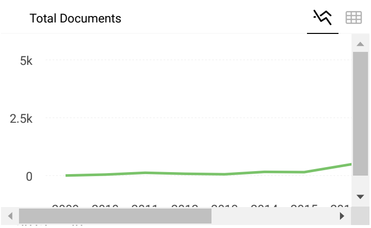
Quartiles

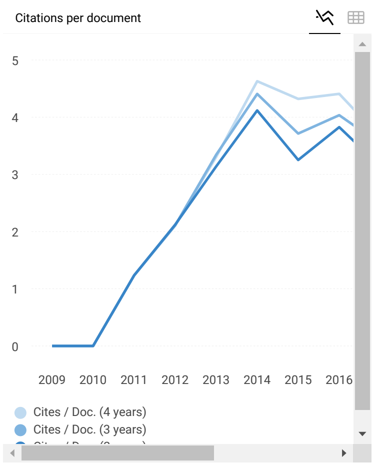
FIND SIMILAR JOURNALS

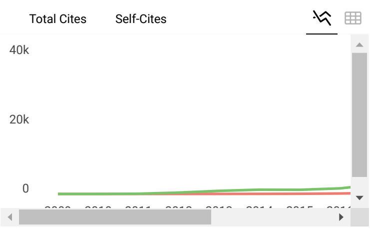
options

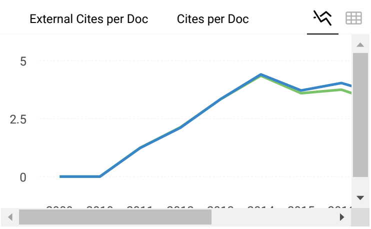
1	2	3	4	5
Polymer Reviews	**Macromolecular Materials and Engineering**	**Polymer Bulletin**	**Express Polymer Letters**	**Polymer International**
USA	DEU	DEU	HUN	GBR
82% similarity	**75%** similarity	**74%** similarity	**74%** similarity	**73%** similarity

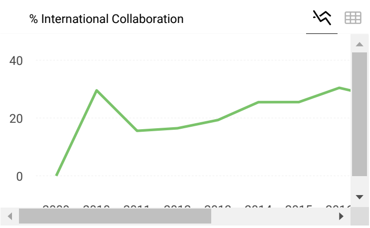


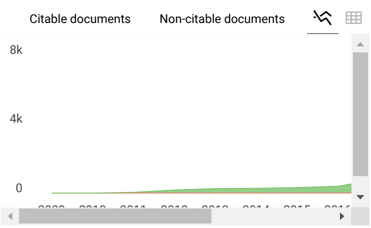


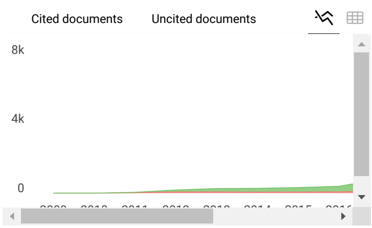


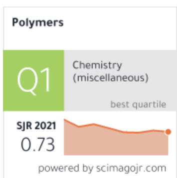












← Show this widget in your own website

Just copy the code below and paste within your html code:

<a href="https://www.scimag

SCImago Graphica

Explore, visually communicate and make sense of data with our **new data visualization tool**.