(양식 1)

【 고분자학회 학회상 포상 지원서 】

[표지]

<table>
<tr><td>공모분야</td><td colspan="5">TCI고분자학술진보상</td></tr>
<tr><td rowspan="5">지원자
인적사항</td><td rowspan="2">성 명</td><td>한 글</td><td>서성백</td><td rowspan="2">영 문</td><td rowspan="2">Sungbaek Seo</td></tr>
<tr><td>한 자</td><td>徐成白</td></tr>
<tr><td rowspan="3">소속기관</td><td>기관명</td><td colspan="3">부산대학교</td></tr>
<tr><td>부서명
(학과명)</td><td>바이오소재과학과</td><td>직위/직급</td><td>부교수</td></tr>
<tr><td>주 소</td><td colspan="3">경남 밀양시 삼랑진읍 삼랑진로 1268-50</td></tr>
<tr><td>업적요지</td><td colspan="5">천연페놀 고분자(Natural Polyphenol)의 중합과 구조-특성간 분석을 통해 생체적합성 소재 개발 및 친환경 표면기능화를 연구해 오고 있습니다. SCIE급 논문 64편을 게재하였고, 9건의 국내외 특허를 보유하고 있습니다.
분자단위에서의 페놀구조와 특성(항산화력, 표면접착력)간 연관성을 분석하고, 페놀분자 단량체를 중합함과 동시에 의료기기의 표면코팅 제어 및 세포부착성, 항균성 등의 기능성을 부여하였습니다(J. Funct. Biomater. 2024). 외부 환경요인에 대해 안정적이고 높은 항산화력을 가진 타닌산 천연페놀을 단량체로 한 중합을 새롭게 시도하였고, 유해 라디칼소거능력을 가진 나노입자화를 통해 암세포 전이성을 억제하는 효과를 입증하였습니다(ACS Appl. Mater. Interfaces 2023).
2022년부터 한국고분자학회 학술교육위원, 운영이사로 활동하였고, 현재 콜로이드 및 분자조립부문위 운영간사를 맡은 경험을 바탕으로 기능성 고분자 산업과 한국고분자학회 발전에 지속적으로 기여하겠습니다.</td></tr>
<tr><td colspan="6">상기와 같이 고분자학회 학회상 포상을 지원합니다.

2025. 7. 22

기관명 : 부산대학교
직 위 : 부교수
지원자 : 서성백 (직인)</td></tr>
</table>

(양식 2)

1. 인적사항

가. 학력사항 (대학교 이상만 기재)

기 간	학 교 명	전공 및 학위, 지도교수
2009. 09 ~ 2014. 05	University of Michigan	고분자공학(박사), Jinsang Kim
2006. 03 ~ 2008. 02	연세대학교	화학공학(석사), 함승주
1999. 03 ~ 2006. 02	연세대학교	화학공학(학사)

나. 경력사항 (5개 이내 기재)

기 간	기관명(직위, 직책 등)
2021. 03 ~ 현재	부산대학교(부교수)
2017. 03 ~ 2021. 02	부산대학교(조교수)
2014. 06 ~ 2017. 02	UC Santa Barbara(박사후 연구원)
2008. 12 ~ 2009. 06	아모레퍼시픽 기술연구원(연구원)

다. 수상경력 (최근 3년 이내)

※ 정부 포상, 민간 포상 등 연구개발 업적 관련 수상경력 모두 기재

일 자	수 상 내 용	시 상 기 관
2024. 02	The Best Inventor	부산대학교 생명산업융합연구원

2. 수상후보자 추천인단 명부

성 명	전 공 분 야	세부전공 분야	소 속	비고
류두열	고분자공학	고분자구조물성	연세대학교 화공생명공학과	
이기라	화학공학	연성나노입자	포항공대 화학공학과	
김병수	고분자화학	고분자합성	연세대학교 화학과	

3. 대표논문의 연구업적 요약서

천연페놀 고분자의 표면접착 및 소재 기능화

○ 천연페놀 항산화력에 의한 암세포 전이 억제

- 기존 연구에서는 천연폴리페놀을 포함한 추출물을 분석하거나 이용했기 때문에 단분자 단위의 기능적 역할에 대해 명확히 설명할 수 없었습니다. 본 논문에서는 분자단위로 페놀구조와 항산화력간 연관성을 분석하고, 안정적이고 높은 항산화력을 갖는 타닌산을 찾을 수 있었습니다. 이를 나노입자에 표면개질함으로써 암세포 전이성이 현저히 낮아지는 것을 밝혔습니다(대표논문2: *ACS Appl. Mater. Interfaces* 2023).

○ 천연페놀 고분자 기반 미세플라스틱 응집 및 제거

- 폐수정제용으로 상용화된 양이온성 고분자에 천연페놀을 결합시켜 수분이내 미세플라스틱을 응집시키고 제거효율을 향상시켰습니다. 특히, 크기와 플라스틱 종류(PS, PE, PMMA)에 상관없이 높은 제거효율을 갖는 범용성 응고제(coagulant)를 개발했습니다(대표논문3: *J. Ind. Eng. Chem.* 2023).

○ 천연페놀 기반 미세플라스틱 응고제 개발

- 기존 양이온성 고분자나 금속염 기반의 응고제를 대체할 수 있는 친환경 천연페놀을 미세플라스틱간 응집 유도로 사용하고 막 제거기술을 통해 정제된 수질의 유효성을 in vivo상태에서 평가했습니다. 해당 기술은 국내특허 등록을 통해 기술이전을 준비중입니다(대표논문5: *Nanotoxicology* 2021).

나노입자를 기반으로한 조직접착제 및 센서 개발

○ 실리카 나노입자 기반 조직접착제

- 시아노아크릴레이트 기반의 조직접착제는 염증을 유발하고, 상처회복이 지연되는 단점을 가진 반면, 본 논문에서 제시한 실리카 나노입자 조직접착제는 염증을 완화하고 조직재생 인자를 발현시키며 상처봉합의 효과를 가집니다. 이를 바탕으로 천연페놀 고분자를 포러스실리카에 접합한 함염증 조직접착제 개발을 연구중입니다(대표논문1: *J. Funct. Biomater.* 2024).

○ 공액고분자 나노리포좀 기반 색변이 센서

- 폴리다이아세틸렌 나노리포좀을 이용하여 음식물 부패의 마커가 되는 생체아민(biogenic amine)을 감지할 수 있는 휴대용 비드기반 센서를 개발하였습니다. 해당 비드기술을 이용하여 식음료내 항노화 유효성분 감지를 위한 센서키트를 국외특허 등록중입니다(대표논문4: *Food Chemistry* 2023).

4. 연구개발 실적

(1) 업적 총괄 (단위:건)

논문	SCIE 등재 학술지				h-index		
	제1저자	공동저자	교신저자	소계	Web of Science	Google Scholar	SCOPUS
	11	33	20	64	23	26	23

특허	국내	국외	기술이전	연구 보고서	저서
	등록	등록			
	5	4	-	-	3

*h-index 증빙자료(화면캡처본) 제출.

(2) 대표논문 목록

제 목	발표지명	Impactor factor	발표 년도	역할 (저자)	저자수 (명)	피인용 횟수
Effect of Silica Nanoparticle Treatment on Adhesion between Tissue-like Substrates and In Vivo Skin Wound Sealing	Journal of Functional Biomaterials	5.0	2024	교신	7	0
Antioxidative impact of phenolics-loaded nanocarriers on cytoskeletal network remodeling of invasive cancer cells	ACS Applied Materials & Interfaces	10.3	2023	교신	8	7
Phenolic-modified cationic polymers as coagulants for microplastic removal	Journal of Industrial and Engineering Chemistry	6.7	2023	교신	9	11
Polydiacetylene-based hydrogel beads as colorimetric sensors for the detection of biogenic amines in spoiled meat	Food Chemistry	9.2	2023	교신	11	37
In vivo impact assessment of orally administered polystyrene	Nanotoxicology	5.9	2021	교신	5	54

nanoplastics: Biodistribution, toxicity and inflammatory response in mice						

*제목 및 저자를 확인할 수 있는 증빙자료 제출.

(3) 총괄연구업적 목록

□ 학술지 논문 - SCIE 등재지에 한함

제 목	발표지명	Impactor factor	발표 년도	역할 (저자)	저자수 (명)	피인용 횟수
Differential response of SNU-1826 colon cells on the autophagy, ER stress, and inflammation during the regulation of microplastic internalization	The Journal of Toxicological Sciences	1.8	2025	공동	13	0
Fabrication of self-repairing and low-swelling polymer network via dynamic boronic ester bonds for enhanced membranes longevity and stability	Journal of Industrial and Engineering Chemistry	5.9	2025	공동	7	0
Metal-Phenolic Coordination mediated Nanoemulsions for All-in-One Drug Delivery	ACS Applied Bio Materials	4.7	2025	교신	13	0
Ionic Character and Alkyl Chain Length of Surfactants Affect Titanium Dioxide Dispersion and Its UV-Blocking Efficacy	Applied Sciences	2.5	2024	교신	13	0
Effect of Silica Nanoparticle Treatment on Adhesion between Tissue-like Substrates and In Vivo Skin Wound Sealing	Journal of Functional Biomaterials	5.0	2024	교신	7	0
Microbead-Based Colorimetric and Portable Sensors for Polyphenol	ACS Omega	3.7	2024	교신	12	1

Detection						
Association Between Cytokeratin 19-Specific IgG and Neutrophil Activation in Asthma	Allergy, Asthma & Immunology Research	4.1	2024	공동	7	2
Antiadhesive Hyaluronic Acid-Based Wound Dressings Promote Wound Healing by Preventing Re-Injury: An In Vivo Investigation	Biomedicines	3.9	2024	공동	14	7
Electrosorption-Driven Remediation of PFAS-Contaminated Water Using a MXene Nanosheet-PEDOT:PSS Adsorbent	ACS Applied Engineering Materials	3.5	2024	공동	6	8
Complement C3-Deficiency-Induced Constipation in FVB/N-C3em1Hlee/Korl Knockout Mice Was Significantly Relieved by Uridine and Liriope platyphylla L. Extracts	International Journal of Molecular Sciences	5.6	2023	공동	14	2
Antioxidative impact of phenolics-loaded nanocarriers on cytoskeletal network remodeling of invasive cancer cells	ACS Applied Materials & Interfaces	10.3	2023	교신	8	6
Characterisation of changes in global genes expression in the lung of ICR mice in response to the inflammation and fibrosis induced by polystyrene nanoplastics inhalation	Toxicological Research	3.0	2023	공동	9	14
Anti-Atopic Dermatitis Effects of Abietic Acid Isolated from Rosin under Condition Optimized by Response Surface Methodology in	Pharmaceuticals	5.2	2023	공동	10	6

DNCB-Spread BALB/c Mice						
Phenolic-modified cationic polymers as coagulants for microplastic removal	Journal of Industrial and Engineering Chemistry	6.7	2023	교신	9	11
Polydiacetylene-based hydrogel beads as colorimetric sensors for the detection of biogenic amines in spoiled meat	Food Chemistry	9.2	2023	교신	11	41
Ninhydrin Loaded Microcapsules for Detection of Natural Free Amino Acid	Chemosensors	4.2	2023	교신	9	12
Novel role of Dipterocarpus tuberculatus as a stimulator of focal cell adhesion through the regulation of MLC2/FAK/Akt signaling pathway	Cell Adhesion & Migration	3.4	2022	공동	10	6
User-demand fast-curable ocular glues enforced by multilength tunable network	Bioengineering & Translational Medicine	10.7	2022	공동	10	6
Promoting Effects of Titanium Implants Coated with Dipterocarpus tuberculatus Extract on Osseointegration	ACS Biomaterials Science & Engineering	4.7	2022	교신	10	7
Inflammatory response in the mid colon of ICR mice treated with polystyrene microplastics for two weeks	Laboratory Animal Research	2.9	2021	공동	8	36
In vivo impact assessment of orally administered polystyrene nanoplastics: Biodistribution, toxicity and inflammatory	Nanotoxicology	5.9	2021	교신	5	65

response in mice						
Effect of substituents in mussel-inspired surface primers on their oxidation and priming efficiency	ChemistryOpen	2.9	2021	교신	5	4
Polydiacetylene liposome microarray toward facile measurement of platelet activation in whole blood	ACS Sensors	7.7	2021	공동	7	22
Development of polydiacetylene-based testosterone detection as a model sensing platform for water-insoluble hormone analytes	Chemosensors	3.3	2021	교신	6	10
Novel characterization of constipation phenotypes in ICR mice orally administrated with polystyrene microplastics	International Journal of Molecular Sciences	5.9	2021	공동	8	27
Removal of microplastics via tannic acid-mediated coagulation and in vitro impact assessment	RSC Advances	3.3	2021	교신	4	74
Recent Purification Technologies and Human Health Risk Assessment of Microplastics	Materials	3.0	2020	교신	4	26
Self-Adherent Biodegradable Gelatin-Based Hydrogel Electrodes for Electrocardiography Monitoring	Sensors	3.2	2020	공동	10	43
α-Linolenic Acid-Enriched Cold-Pressed Perilla Oil Suppress High-Fat Diet-Induced Hepatic Steatosis through Amelioration of the ER Stress-Mediated Autophagy	Molecules	3.2	2020	공동	13	31
Mussel-inspired surface acrylation on graphene	ChemistrySelect	1.7	2020	교신	8	2

oxide using acrylic surface primers and its hydrogel-based applications: Sustained drug release and tissue scaffolds						
Effect of surface charge of gold nanoparticles on fluorescence amplification of polydiacetylene-based liposomes	Journal of Experimental Nanoscience	2.1	2020	교신	10	6
Self-healable superomniphobic surfaces for corrosion protection	ACS Applied Materials & Interfaces	8.4	2019	공동	6	56
Natural polyelectrolyte complex-based pH-dependent delivery carriers using alginate and chitosan	Journal of Applied Polymer Science	2.1	2019	교신	3	14
Naked-eye detection of pandemic Influenza A (pH1N1) virus by polydiacetylene (PDA)-based paper sensor as a point-of-care diagnostic platform	Sensors & Actuators: B. Chemical	6.3	2019	공동	10	81
Expression of steroidogenic enzymes in human placenta according to the gestational	Molecular Medicine Reports	1.8	2019	공동	11	18
Effect of polydiacetylene-based nanosomes on cell viability and endocytosis	Nanotechnology	3.3	2019	교신	7	10
Laxative effect of spicatoside A by cholinergic regulation of enteric nerve in loperamide-induced constipation: ICR mice model	Molecules	3.0	2019	공동	10	36
Metal ion-mediated interliposomal	Journal of Nanoscience	1.0	2019	교신	7	5

aggregation of polydiacetylene liposomes incorporating a phenolic lipid	and Nanotechnology					
Scalable Synthesis of an Architectural Library of Well-Defined Poly(Acrylic Acid) Derivatives: Role of Structure on Dispersant Performance	Journal of Polymer Science, Part A: Polymer Chemistry	2.5	2019	주저자	18	24
In situ Photocrosslinkable Hyaluronic Acid-Based Surgical Glue with Tunable Mechanical Properties and High Adhesive Strength	Journal of Polymer Science, Part A: Polymer Chemistry	2.5	2019	공동	6	67
Therapeutic effects of a liquid bandage prepared with cellulose powders from Styela clava tunics and Broussonetia kazinoki bark: Healing of surgical wounds on the skin of Sprague Dawley rats	Molecular Medicine Reports	1.8	2019	공동	13	16
Rapid Light-Driven Color Transition of Novel Photoresponsive Polydiacetylene Molecules	ACS Applied Materials & Interfaces	8.0	2018	주저자	3	23
Significant Performance Enhancement of Polymer Resins by Bioinspired Dynamic Bonding	Advanced Materials	19.7	2017	주저자	15	88
Advances in medical adhesives inspired by aquatic organisms' adhesion	Biomaterials Research	2.2	2017	교신	4	43
A di-tert-butyl acrylate monomer for controlled radical photopolymerization	Journal of Polymer Science Part A: Polymer Chemistry	2.9	2017	공동	9	9
Underwater contact adhesion and microarchitecture in	Nature Materials	38.8	2016	공동	7	492

polyelectrolyte complexes actuated by solvent exchange						
Microphase behavior and enhanced wet-cohesion of synthetic copolyampholytes inspired by a mussel foot protein	Journal of the American Chemical Society	12.1	2015	주저자	8	165
Stimuli-Responsive Matrix-Assisted Colorimetric Water Indicator of Polydiacetylene Nanofibers	ACS Applied Materials & Interfaces	6.7	2015	주저자	5	58
Highly sensitive turn-on biosensors by regulating fluorescence dye assembly on liposome surfaces	Chemical Communications	6.8	2015	주저자	5	21
Dual-Mode Waveguiding of Raman and Luminescence Signals in a Crystalline Organic Microplate	Journal of Materials Chemistry C	4.6	2014	공동	8	21
Tailoring Intermolecular Interactions for Efficient Room-Temperature Phosphorescence from Purely Organic Materials in Amorphous Polymer Matrices	Angewandte Chemie	11.3	2014	공동	5	485
Janus-compartmental microbeads having polydiacetylene liposomes and magnetic nanoparticles for visual lead (II) detection	ACS Applied Materials and Interfaces	5.9	2014	공동	9	84
Polydiacetylene liposome microarray toward influenza A virus detection: effect of target size on turn-on signaling	Macromolecular Rapid Communications	4.9	2013	주저자	6	81
A molecular design	Nature	35.7	2013	공동	6	302

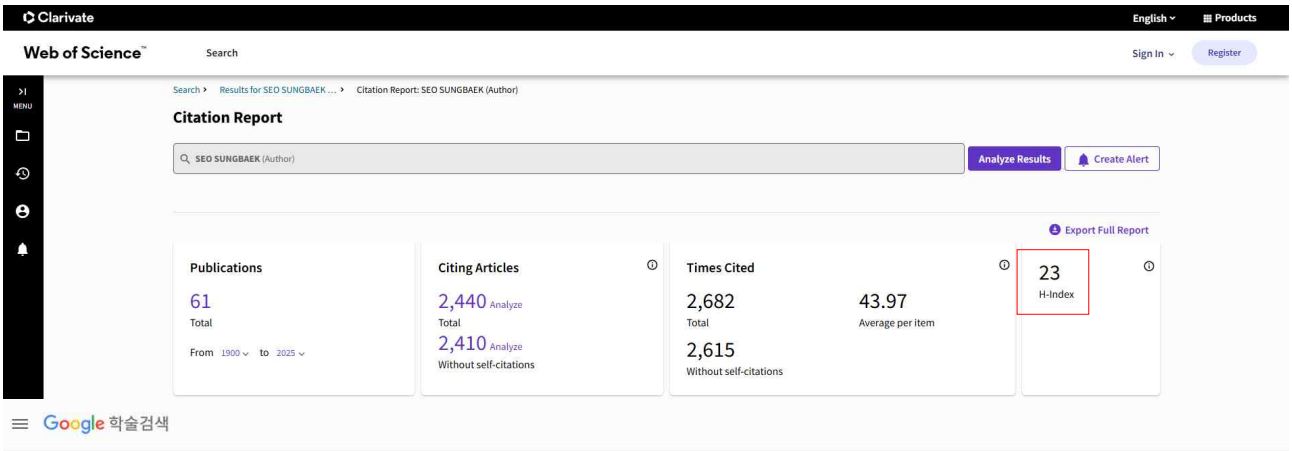
principle of lyotropic liquid-crystalline conjugated polymers with directed alignment capability for plastic electronics	Materials					
Colorimetric detection of warfare gases by polydiacetylenes toward equipment-free detection	Advanced Functional Materials	10.1	2012	공동	3	150
Design of polydiacetylene-phospholipid supramolecules for enhanced stability and sensitivity	Langmuir	4.1	2012	공동	7	71
Biomimetic detection of aminoglycosidic antibiotics using polydiacetylene–phospholipids supramolecules	Chemical Communications	6.1	2012	공동	8	67
Multifunctional Nanoparticles for Photothermally Controlled Drug Delivery and Magnetic Resonance Imaging Enhancement	Small	6.2	2008	공동	8	196
Smart nanoprobes for ultrasensitive detection of breast cancer via magnetic resonance imaging	Nanotechnology	3.8	2008	공동	8	23
Enhancement of magnetic resonance contrast effect using ionic magnetic cluster	Journal of Colloid and Interface Science	2.6	2008	주저자	9	25
Nanohybrids via polycation-based nanoemulsion method for dual-mode detection of human mesenchymal stem cells	Journal of Materials Chemistry	4.6	2008	주저자	10	16
Enhancement of cellular binding efficiency and cytotoxicity using polyethylene glycol base	Journal of Biomedical Materials Research	3.5	2007	공동	8	24

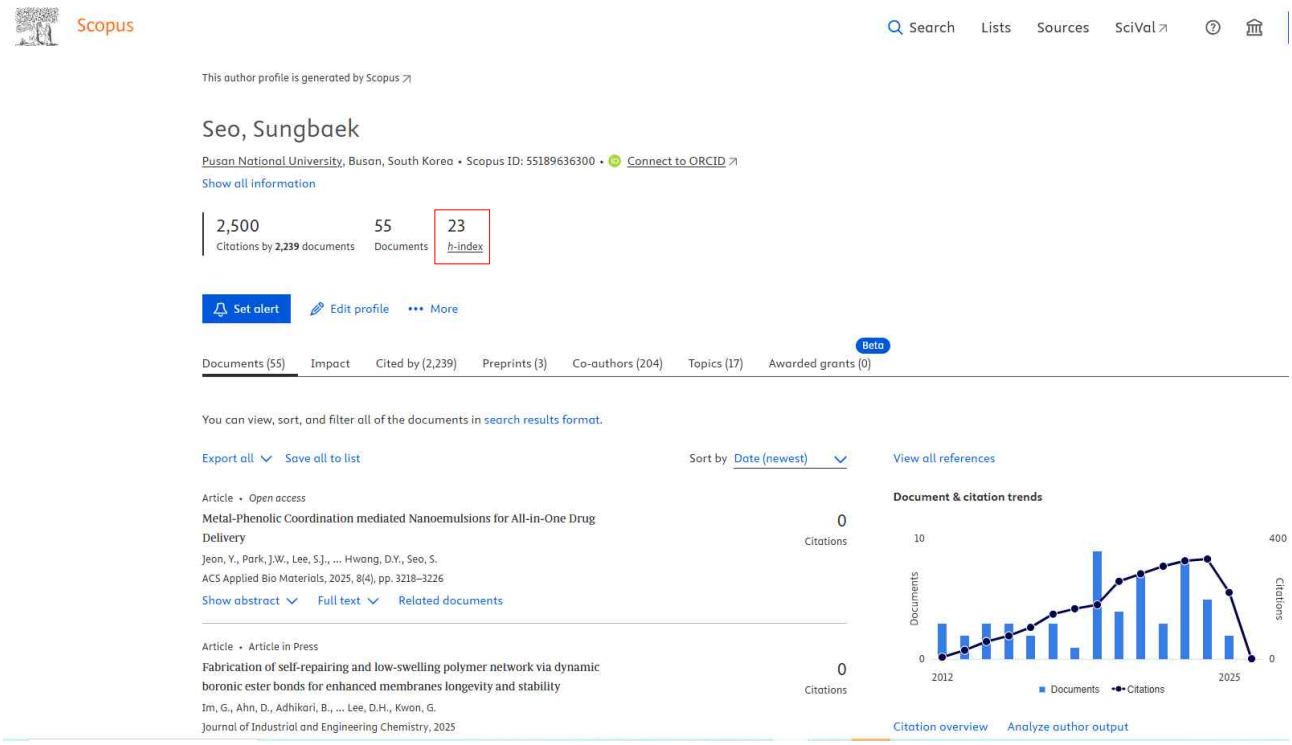
triblock copolymeric nanoparticles for targeted drug delivery	Part A					
Novel multifunctional PHDCA/PEI nano drug carriers (MPDCs) for simultaneous magnetically-targeted cancer therapy and diagnosis via magnetic resonance imaging (MRI)	Nanotechnology	3.8	2007	주저자	10	51
Antibody conjugated magnetic PLGA nanoparticles for diagnosis and treatment of breast cancer	Journal of Materials Chemistry	4.2	2007	공동	10	237

□ **등록**된 국내외 특허

제 목	등록번호	등록년도	등록처	역할
디프테로카르푸스 투베르쿨라투스 추출물을 포함하는 골유착 개선용 조성물	10-2715507	2024	대한민국	발명자
미세플라스틱 제거 방법	10-2497219	2023	대한민국	주발명자
Scale inhibition using star polymers	US2020/015388	2020	미국	발명자
Branched polymeric dispersants, aqueous pigment dispersions, and aqueous coating compositions thereof	US2019/044640	2020	미국	발명자
Polydiacetylene Nanofibers for Colorimetric and Ampherometric Sensors	US2016/0349223	2019	미국	주발명자
금속 나노 복합체, 이의 제조 방법 및 용도	10-1084435	2011	대한민국	발명자
자성 나노복합체, 그 제조 방법 및 상기를 포함하는생물의학적 조성물	10-1000480	2010	대한민국	발명자
Metal nanocomposite, preparation method and use thereof	US8916134 B2	2014	미국	발명자
표적부위자기약물전달과 조영제를 위한 양이온성 자성나노복합체	10-0862973	2008	대한민국	발명자

[별첨1] h-index 증빙자료(화면캡처본)





[별첨2] 대표논문 목록(5편)

1. Effect of Silica Nanoparticle Treatment on Adhesion between Tissue-like Substrates and In Vivo Skin Wound Sealing(*J. Funct. Biomater.* 2024)

Journal of *Functional Biomaterials*

MDPI

Article

Effect of Silica Nanoparticle Treatment on Adhesion between Tissue-like Substrates and In Vivo Skin Wound Sealing

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Abstract: Silica nanoparticles are innovative solutions of surgical glue that can readily adhere to various tissue-like substrates without the need for time-consuming chemical reactions or ultraviolet irradiation. Herein, 10 nm-sized silica nanoparticle ($SiNP_{10}$) treatment exhibited maximum adhesion strength in the porcine heart tissue model, which was approximately 7.15 times higher than that of the control group of non-treatment. We assessed the effects of silica nanoparticle treatment on in vivo skin wounds by scoring tissue adhesion and inflammation using histological images. Compared to the commercial cyanoacrylate skin adhesive (Dermabond), suppression of inflammatory cytokine levels in the incision wound skin was observed. We further quantified the expression of angiogenic growth factors and connective tissue formation-related proteins. On day 5 after wound closing treatment, the expression levels of PDGF-BB growth factor were significantly higher in $SiNP_{10}$ treatment (0.64 ± 0.03) compared to Dermabond (0.07 ± 0.05). This stimulated angiogenesis and connective tissue formation in the skin of the incision wound may be associated with the promoting effects of $SiNP_{10}$ treatment on wound closure and tissue adhesion.

Keywords: inflammation; silica nanoparticles; surgical glue; tissue adhesion; wound healing

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1. Introduction

Traumatic injury is a leading cause of death in Europe and the United States [1]. Millions of surgical procedures are performed annually for injury treatment [2]. Surgical procedures require rapid wound closure techniques to reduce inflammation, infection, and scarring. Accordingly, the global wound care market was approximately $12 billion in 2020 and is estimated to grow to $18.7 billion by 2027 [3].

Sutures and staples are standard biomaterials used for wound closure [4–6]. Sutures are widely used for wound treatment; however, they are difficult to apply in minimally invasive surgeies and pose a high risk of infection [7]. Additionally, the tension applied to the wound after suturing can cause complications such as inflammation and scar enlargement [6–8]. Staples are simpler than sutures and allow quick closure; however, the risk of infection and wound complications are higher with staples than with sutures [5,9].

Polymer-based adhesives have been suggested because of their good contact with surfaces and the ability to maintain the fracture of the wound area by dissipating energy under pressure. However, they require complex processes, such as in situ polymerization [10,11], and the active oxygen generated during polymerization can damage healthy tissues [12]. Polymer-based adhesives exhibit moisture-absorbing properties, a high expansion rate, and can suppress nerves, which limits their usage [12,13]. Accordingly, adhesive materials with convenience, low toxicity, and high wound-sealing ability are required.

2. Antioxidative impact of phenolics-loaded nanocarriers on cytoskeletal network remodeling of invasive cancer cells(*ACS Appl. Mater. Interfaces* 2023)

ACS APPLIED MATERIALS & INTERFACES

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Antioxidative Impact of Phenolics-Loaded Nanocarriers on Cytoskeletal Network Remodeling of Invasive Cancer Cells

Jaewon Jung,[#] Minhee Ku,[#] Suhui Jeong,[#] Nara Yoon, Jae Hyun Park, Han Sung Youn, Jaemoon Yang,* and Sungbaek Seo*

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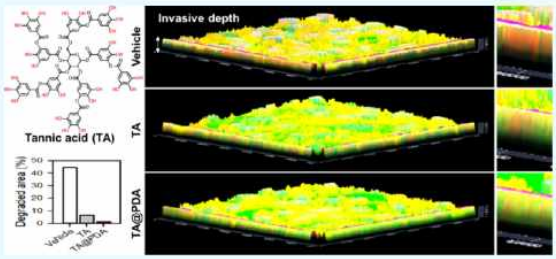
ABSTRACT: Natural phenolic compounds have antioxidant properties owing to their free radical-scavenging capability. The combined effect of a mixture of phenolic compounds has been studied; however, the detailed investigation for finding a correlation between single phenolic molecules and antioxidant activity has not been explored. Herein, we revealed that the number of phenolic hydroxyl groups in phenolics played a central role in their antioxidant capacity. Based on the finding, tannic acid showed the most effective antioxidant potential, e.g., 76% in tannic acid versus 22% in vitamin C as a standard antioxidant component. Because cancer progression is closely related to oxidative processes at the cellular level, we further applied the surface treatment of tannic acid drug-delivery nanocarriers. Tannic acid-loaded nanocarriers reduced reactive oxygen species of cancer cells as much as 41% of vehicle treatment and remodeled cytoskeletal network. By a gelatin degradation study, TA-loaded nanocarrier-treated cells induced 44.6% reduction of degraded area than vehicle-treated cells, implying a potential of blocking invasiveness of cancer cells.



KEYWORDS: *antioxidant, cancer cell, cytoskeletal network, invasive potential, phenolics*

1. INTRODUCTION

Phenolic compounds are common phytochemicals found in plant tissues, such as fruits and vegetables. They possess various bioactive properties, particularly antioxidative properties, owing to their free radical-scavenging capability. For this reason, natural phenolic compounds have been utilized as anti-aging components or additives in cosmetics, dietary supplements, and pharmaceuticals.[1−3] For example, well-known natural phenolic compounds in medicinal herbs have been widely used as anti-aging and dietary supplements.[4,5] The antioxidant performance of plant and fruit extracts and their health benefits have been investigated with the contribution of natural phenolic compounds inside.[6] For instance, the resveratrol extract shows very high antioxidant activity and potential cardioprotective and anticarcinogenic effects.[7] In addition, berry seed meals were identified as a good source of phenolic compounds that can inhibit copper-induced low-density lipoprotein-cholesterol oxidation and DNA damage, indicating that phenolic compounds may prevent atherosclerosis, mutagenesis, and carcinogenesis.[8−10] However, because the extract is a mixture of several constituents, including phenolic molecules (phenolics), researchers could not isolate the particular effect of single phenolics from the combined effect of the mixture.

Free radicals are molecular species with unpaired electrons in atomic orbitals. They are highly reactive, unstable, and can damage essential biomolecules, such as DNA, proteins, carbohydrates, and lipids in nuclei and cell membranes of the human body.[11] Phenolics can scavenge free radicals or antioxidants by transferring the hydrogen atom of the phenolic ring to free radicals. Delocalized or activated radical phenolics have high chemical stability due to the benzene ring resonance effect. Therefore, biological damage or deleterious oxidative stress caused by the free radicals surrounding the cells can be reduced in the presence of phenolics. Rigoussen et al.[12] reported that the antioxidant efficiency of biophenolics is closely related to the number of mesomeric forms of the phenolic ring structures—the more mesomeric the forms, the more efficient the antioxidation. In addition, the antioxidant efficiency is linked to substituting the aromatic ring in ortho- and para-positions and their steric hindrance.[13,14] However, to the best of our knowledge, the systematic correlation between the molecular structure of single phenolics and antioxidant activity and their influence on cell behavior is not fully understood.

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3. Phenolic-modified cationic polymers as coagulants for microplastic removal(*J. Ind. Eng. Chem.* 2023)

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Phenolic-modified cationic polymers as coagulants for microplastic removal

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ABSTRACT

Owing to the potential toxicological threat to the environment and human health associated with microplastics, researchers have increasingly focused on microplastic removal in wastewater treatment. Inspired by natural processes, metal–phenolic coordination bonds have been applied to microplastic coagulation using surface phenolic-modified beads. The scope of candidate materials for cationic polymer and phenolic molecules involved in the coagulation process was expanded for surface modification, yielding a high removal efficiency (>90%) of polystyrene beads. To reduce the complexity of the two-material treatment approach, tannic acid–chitosan conjugates were synthesized as a single coagulant – phenolic-modified cationic polymer. The polymers were effectively modified on the surface of the polystyrene beads, and they demonstrated dramatic coagulation behavior within 5 min following the introduction of $FeCl_3$ additive. The removal efficiency of the beads exceeded 80% for all tested polymer types. The effects of purified and non-purified microplastic solutions were compared in cell studies, and the oxidative stress and inflammatory response in cells treated with purified solutions were reduced to levels similar to those observed without exposure to the bead solution.

Introduction

As the plastic industry grows, plastic production continues to expand rapidly [1–6], leading to uncontrollable amounts of waste plastics (420 million tons in 2017) accumulating in wastewater globally [7]. In addition, the estimated annual intake of microplastics (MPs, less than 5 mm in size) per person is 74,000–121,000, which is equal to consuming the amount of plastic comprising one credit card per week [8,9]. Recent studies have shown that humans are exposed to residual MPs through a variety of sources, including bottled water and food [9,10]. MPs are characterized by a large surface area, polarity, and functional groups that can readily combine with toxic organic pollutants and heavy metals [11,12]. Because of these properties, potential toxicological risks of MPs to the environment and humans have been reported [11]. Studies on the risks of MPs both *in vitro* and *in vivo* have revealed that various associated detrimental responses, such as cytotoxicity, inflammatory responses, and oxidative stress, are dependent on the polymer type, size, and shape of MPs [12–17].

To purify water containing MPs, researchers have applied various technical approaches such as biological degradation, membrane filtration, and coagulation (MP clustering and precipitation) [12,18]. Coagulation and subsequent ultrafiltration have been demonstrated to efficiently remove MPs from water resources. Both Al- and Fe-based salts ($AlCl_3$ and $FeCl_3$) have been widely used as chemical additives/coagulants for coagulation [19,20]. Coagulation technology for water treatment can increase the size of MPs, thus allowing the efficient purification of water through filtration. However, the removal efficiency of MPs using $AlCl_3$ is less than 40%, even when a very high dose (15 mM) is used [21]. To improve the removal efficiency of MPs, polymers such as polyacrylamide or poly(diallyldimethyl-ammonium chloride) (PDADMAC) combining with the metal salts have been used in coagulation [22–24] – the removal efficiency of MPs has not yet exceeded 60%.

We previously demonstrated the surface modification of MPs as phenolics using chitosan and tannic acid (TA). $FeCl_3$ coagulant triggered dramatic MP coagulation after surface modification and

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4. Polydiacetylene-based hydrogel beads as colorimetric sensors for the detection of biogenic amines in spoiled meat(*Food Chemistry* 2023)

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Polydiacetylene-based hydrogel beads as colorimetric sensors for the detection of biogenic amines in spoiled meat

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Biogenic amine
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ABSTRACT

Ingesting large quantities of biogenic amines (BAs), which are released from spoiled foods, can have adverse side effects on the human body. Herein, we developed a colorimetric sensor using polydiacetylene (PDA)-based hydrogel beads that change color upon binding with BAs, thereby conveniently checking whether food is spoiled due to improper storage and distribution. The colorimetric sensor is fabricated by mixing PDA liposomes with an alginate solution. PDA undergoes a color change from blue to red when exposed to various external stimuli. In addition, alginate bestows the hydrogel with a three-dimensional porous structure, affording a large surface area. The PDA-based hydrogel beads can visually confirm the presence of BAs in solution or vapor form. Cadaverine and propylamine were rapidly detected with distinct color changes in the solution and vapor phases, respectively. The spoilage of pork meat at room temperature could be detected after two days as a 40.84% red chromatic shift.

1. Introduction

Various types of low-molecular-weight organic nitrogen compounds known as biogenic amines (BAs) are released during the decomposition of foods, such as fish, meat, and cheese (Ahangari et al., 2021; Doeun et al., 2017; Nuñez et al., 2015). While small amounts of BAs are necessary for biological functions, such as the synthesis of hormones, alkaloids, nucleic acids, and proteins, and can be detoxified by intestinal amine oxidase, they can lead to serious health problems when ingested in large quantities, because the detoxifying ability of amine oxidase can be disrupted or inhibited (Bachrach, 2005; Tofalo et al., 2015). The level of toxicity depends on the amount of BAs ingested and the sensitivity of an individual and common side effects include nausea, vomiting, diarrhea, headaches, and high blood pressure (Doeun et al., 2017; Fu et al., 2019; Tofalo et al., 2015; Verma et al., 2020).

Meat and meat products spoil particularly fast if not stored under optimal conditions (Kim et al., 2021; Nguyen et al., 2019; Valdez et al., 2019; Weston et al., 2020). The most common BAs released from the decomposition of meat proteins are trimethylamine, putrescine, and cadaverine (Bachrach, 2005; Valdez et al., 2019). Cadaverine and putrescine can enhance the toxicity of histamine, which causes food poisoning when its levels exceed 1000 ppm and react with nitrites to form carcinogenic nitrosamines (Nout, 2014). Therefore, it is important to avoid consuming these BAs in large quantities. Monitoring the BAs released from food can alert us to food spoilage and reduce wastage and prevent the health problems resulting from consuming spoiled meat (Hu et al., 2016; Kim et al., 2021; Nguyen et al., 2019; Valdez et al., 2019; Weston et al., 2020). Conventional methods for detecting BAs include high-performance liquid chromatography (HPLC), gas chromatography (GC), thin-layer chromatography (TLC), ion-exchange chromatography (IEC), biosensors, and capillary electrophoresis (CE) (Ahangari et al., 2021; Doeun et al., 2017).

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5. In vivo impact assessment of orally administered polystyrene nanoplastics: Biodistribution, toxicity and inflammatory response in mice(*Nanotoxicology* 2021)

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In vivo impact assessment of orally administered polystyrene nanoplastics: biodistribution, toxicity, and inflammatory response in mice

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ABSTRACT

To assess the *in vivo* impact of nanoplastics (NP) and coagulation-based purified NP (PurNP), this study analyzed for alterations in the biodistribution, toxicity and inflammatory response in ICR mice exposed to three different doses of NP (5, 25, and 50 mg/kg) and PurNP for 2 weeks. Except water consumption, which was dose-dependently and significantly increased in all NP-treated groups, most factors assessed for feeding behaviors and excretions remained constant, without any significant change. Orally administered NP was detected in the intestine, kidneys, and liver at all concentrations, although the accumulation was higher in the intestine than in the kidneys and liver. No significant alterations were detected in the levels of serum biochemical markers and histopathological structures. However, compared to the vehicle group, expressions of the inflammatory response proteins (iNOS and COX-2) and mRNA levels of the inflammatory cytokines were remarkably increased in the liver, kidneys, and intestine of NP-treated mice. A similar increase was detected in the oxidative stress responses, including ROS concentration, SOD activity, and Nrf2 expression. Furthermore, similar inflammatory responses were observed in the PurNP-treated group, as compared to the vehicle-treated group. The results presented in this study provide the first strong evidence that oral administration of NP for 2 weeks results in high accumulation in the liver, kidneys, and intestine of ICR mice, and induces severe inflammatory and oxidative stress responses. These results additionally confirm the efficacy of water purification using the tannic acid-mediated coagulation removal technique.

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1. Introduction

Microplastics (MP) are defined as plastics smaller than 5 mm (Law and Thompson 2014; Andrady 2017; Mintenig et al. 2018). The prevalent exposure of the environment and humans to MP has raised concerns related to the potential health risk from these particles. While most studies have focused on the toxicological effects of MP in aquatic organisms, there is limited research on the *in vivo* biodistribution and risk assessment of MP in mammals (Deng et al. 2017; Jin et al. 2019; Yang et al. 2019). Lehner et al. (2019) and Thushari and Senevirathna (2020) reported that MP are similar in size to food particles of marine organisms, and are most susceptible to exposure in aquatic systems. Deng et al. (2017) studied the tissue distribution and accumulation of 5 μm and 20 μm polystyrene (PS) MP in mice, and observed tissue-specific health risks after exposure to MP (Deng et al. 2017), including disruption of energy, lipid metabolism, oxidative stress, and neurotoxicity. To date, microbeads ranging in diameter from 1 to 200 μm have mainly been investigated for their toxicological and pathological effects *in vitro* or *in vivo*, since this is the technically discriminable and prevalent size range of plastic fragments in the water environment. In particular, the small size and large surface area properties of nanoplastics (NP; smaller than 1 μm; Gigault et al. 2016; Andrady 2017) increase the transport of environmental and biological pollutants, as well as promote the *in vivo* accumulation rate (Estrela et al. 2021). Moreover, recent years have seen an ease of

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