PSS15B : 미래형 헬스케어 의료기기 심포지움

PSS15B-1 | Solvent-free preparation of idebenone-containing nanoparticles with efficient wound healing and antioxidant properties

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ROS caused by UV rays, blue light, and fine dust harm the skin and cause urban aging. Excessive production of reactive oxygen species (ROS) causes harmful effects, including biomolecular damage and inflammation. Therefore, there is a need for powerful antioxidants that relieve the oxidative stress of the skin and eliminate ROS. Idebenone (IB) is a powerful antioxidant, but poorly soluble and thus poorly soluble in water, resulting in low bioavailability. In this study, IB-loaded nanoparticles (IB@NPs) were synthesized by loading IB without an organic solvent into nanoparticles that can provide high loading efficiency and stability for solubilization. In fact, synthesized IB@NPs showed long-term stability through dynamic light scattering, methylene blue staining and redispersion analysis, and IB@NPs prepared with 5 wt% IB loading content were found to be optimal. The antioxidant activity of IB@NPs, assessed using the DPPH assay, was significantly higher than that of unloaded IB. Furthermore, IB@NPs showed good biocompatibility according to the in vitro DPPH antioxidant assay, inhibited oxidative damage to mouse NIH-3T3 fibroblasts, and reduced intracellular ROS production. In particular, IB@NP significantly promoted wound healing in vitro, as demonstrated in the scratch assay. Therefore, as carriers with good stability, IB@NPs have potential cosmetic and pharmaceutical applications.

PSS15B-2 | 주사형 미용 필러를 위한 인산칼슘 미네랄 기반 결정 복합 다당류 하이드로겔

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The dermal fillers need to acquire biodegradable, non-immunogenic, biocompatible, and properties. According to their durability, they are categorized as temporary, semipermanent, and permanent. Among the diverse filers, HA-founded semipermanent or temporary fillers have been most broadly applied, owing to their conformed safety in clinic. Calcium phosphate mineral based crystalline, termed Hydroxyapatite (HAp), boost fresh collagen production and has a durable efficacy after administration into the skin. Thus, the calcium phosphate mineral based crystalline implanted HA dermal fillers potentiated in highly boosting collagen production after injection. However, the high expenditure of HA confined the use of HA-based dermal filler. Therefore, in this study, we prepared calcium phosphate mineral based crystalline composite polysaccharide hydrogel (bio-ceramic dermal filler) for enhanced durable dermal fillers to enhance its anti-wrinkle effect and residency duration. The stability of the hydrogel with various amount of the bio-ceramic was assessed via in vitro residence stability and in vivo histological analysis. Besides, biocompatibility was examined through immunostaining macrophages after administrated mice. Moreover, construction of collagen and anti-aging efficacy were performed with wrinkle mice model.

PSS15B-3 | 향산된 항산화 및 항균 효과를 위한 포비돈 코팅 일라이트 바이오 세라믹 마이크로 입자

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Illite is a natural aluminosilicate with antioxidant and antimicrobial activities as cosmetics, biocides, and pharmaceuticals. However, it is insoluble in aqueous solution, and its application remains limited due to unsatisfactory bioavailability and electron-donating ability. Therefore, in this study, hydrophilic and biodegradable povidone (PVP) was adsorbed on surface of illite microparticles (P-lite bio-ceramic MPs) enhancing bioactivity and stability. Different sizes of P-lite bio-ceramic MPs were prepared depending on concentrations of PVP. Different analytical techniques including scanning electron microscopy, Fourier-transform infrared spectroscopy, and X-ray photoelectron spectroscopy were used for characterization. The enhanced antioxidant and antibacterial activities of MPs were evaluated using reactive radical scavenging assays and bacterial colony count method. As results, the smaller MPs with larger surface area and more interaction sites exhibited the higher efficacy. The P-lite bio-ceramic MPs were efficient scavenger of reactive oxygen species in the H_2O_2-stressed cells without any cytotoxic effect, indicating its potent application in industrial and biomedical fields.

PSS15B-4 | Development of Hydroxyapatite Binding Peptides for Protein Purification

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Purification of proteins is an important process in

biology and life sciences, where it is essential to isolate proteins in a highly purified state. Affinity chromatography is one of the most widely used techniques in life sciences and chemistry, used to separate or purify molecules based on their specific interaction with a particular ligand or receptor. Hydroxyapatite is a form of calcium phosphate that has long been used in the chromatographic separation of proteins and DNA. In this study, we have developed a specific peptide that binds to hydroxyapatite (HAp), and we aim to utilize it to develop novel protein purification-tag. Here, we identified hydroxyapatite-specific peptides using negative and positive selection in a randomized 8-mer peptide phage library to isolate peptides highly specific to hydroxyapatite. After 4th biopanning, the enrichment of phage is successfully performed and we isolated three excellent peptides. Furthermore, HAp binding-tag was highly specific for hydroxyapatite compared to other calcium salt-based materials. Our study identified novel hydroxyapatite-biding peptide with superior specificity an can be useful for protein purification-tag

PSS15B-5 | Development of novel deinoxanthin-loaded nanoparticles for enhanced antioxdiant and anti-inflammatory therapy with effective stability

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Carotenoids, such as Deinoxanthin (DX), are bioactive fat-soluble compounds known for their potent free radical scavenging capabilities, countering oxidative stress and inflammation. Despite DX's remarkable antioxidant and anti-inflammatory properties, its poor water dispersion limits bioavailability and makes it susceptible to degradation, affecting stability and physiological effects. To overcome these challenges, we developed DX-loaded nanocapsules (DX@NCs) using nanoprecipitation. DX@NCs demonstrated robust long-term stability over four weeks, along with an optimized DX loading content. Their antioxidant activity surpassed that of free DX, even after four weeks, as confirmed by the DPPH assay. Additionally, DX@NCs exhibited excellent biocompatibility and ROS-scavenging abilities in vitro, notably reducing nitric oxide (NO) production. Remarkably, DX@NCs displayed outstanding anti-inflammatory effects. As a highly stable carrier system, DX@NCs hold promise for cosmetic and pharmaceutical applications, offering potent antioxidant and anti-inflammatory benefits.

PSS15B-6 | α-Bisabolol-loaded nanocapsules: Fabricating nanocapsules containing α-Bisabolol to incorporate both antioxidant and antibacterial properties.

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Bioactive compounds are widely used in the bio-industry because of their antioxidant and antibacterial activities. Because preservatives used in bioproducts cause allergies and contact dermatitis, and because of excessive oxidative stress, which causes various diseases in humans, it is important to use natural bioactive compounds in bioproducts to minimize oxidative stress. α-bisabolol (ABS) is a natural compound with both antioxidant and antibacterial properties. However, its water-insolubility makes its utilization in bioproducts difficult. In this study, ABS-loaded polyglyceryl-4 caprate nanocapsules with improved aqueous stability and ABS loading were fabricated using an encapsulation method. The long-term stability of the ABS@NCs was analyzed with dynamic light scattering and methylene blue-staining to determine the optimized ABS concentration in ABS@NCs (10 wt%). The ABS@NCs exhibited excellent antioxidant activity, according to the DPPH assay and in vitro reactive oxygen species generation in NIH-3T3 cells, and an outstanding antibacterial effect, as determined using the S. aureus colony-counting method. Furthermore, we estimated the biocompatibility of the ABS@NCs in vitro. This study shows that ABS@NCs with improved antioxidant and antibacterial properties can be used to treat diseases related to various oxidative stresses and can be applied in many fields, including pharmaceuticals, cosmetics, and foods.

PSS15B-7 | 기체 분리용 페놀 수지 기반 탄소분자체 분리막 제조

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분리막은 물리적 특성이 유사한 물질을 분리할 수 있고, 에너지 소모가 낮은 장점이 있다. 특히, 탄소분자체막은 가혹한 운전조건 속에서도 우수한 기체 분리 성능을 보이며, 이는 탄소분자체의 견고한 슬릿 형태 기공구조와 높은 열적/화학적 안정성에 기인한다. 슬릿 형태 구조는 7~20Å의 micropore와 7Å이하의 ultra-micropore로 구성된다. Micropore는 표면 확산에 의해 높은 투과도를 제공하고, ultra-micropore에서는 분자체 메커니즘에 의해 선택도 향상에 기여한다. 따라서 두 가지 기공 분포를 가지는 탄소막은 높은 투과도와 선택도를 동시에 가질 수 있게 한다. 본 연구에서는 페놀 수지를 합성하여 탄소분자체막 제조

및 기체 분리 성능(H_2, N_2, CO_2, CH_4, C_2H_4/C_2H_6)에 대한 연구를 진행하였다. 레졸 페놀 수지는 염기성 촉매를 이용하여 과량의 포름알데하이드와 몰비별로 반응시켜 합성되었다. 합성된 페놀 수지는 알루미나 디스크 위에 복합막 형태로 제조하였으며, 결함이 없는 페놀 수지 고분자층을 형성시키기 위해 알루미나 졸을 합성하여 수 나노 기공 크기의 알루미나 중간층을 코팅하였다. 탄소분자체 분리막은 페놀 수지 몰비, 열처리 및 열분해 온도 등을 제어하여 기체 분리 성능 평가를 진행하였다.

PSS15B-8 | Fabrication of nanoparticles containing Cyperus rotundus rhizome extract for effective stability with antioxidant and anti-inflammatory benefits

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A diverse range of synthetic antioxidants has been developed to counteract reactive oxygen species and free radicals. However, their effectiveness is often limited, and negative health effects can occur. Consequently, recent attention has shifted towards investigating various plant species. Cyperus rotundus (C. rotundus), a traditional medicinal plant in India, China, and Japan, alleviates spasms and stomach issues. This study employed encapsulation to create CR-loaded SJC-clearsol D nanoparticles, showing enhanced stability and CR loading. Long-term CR@NPs stability analysis used dynamic light scattering and methylene blue staining, identifying optimal CR concentration (10 wt%). These nanoparticles exhibited impressive antioxidant capabilities through the DPPH assay and in vitro ROS generation in NIH-3T3 cells. Furthermore, the CR@NPs displayed exceptional biocompatibility in an in vitro MTT assay. Notably, they exhibited potent anti-inflammatory effects by reducing in vitro NO production, observed in nitric oxide (NO) analysis. In summary, CR@NPs serve as stable carriers for cosmetics and pharmaceuticals, attracting researchers in the search for natural antioxidants.

PSS15B-9 | An improved reforming method using a ferrocene-based copolymer multilayer film with efficient antifouling properties and electrochemical redox properties

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Selective and accurate sensors are needed in preparation for epidemics such as COVID-19. First, Electrochemical sensors requires high sensitivity and uses redox active material. In order to increase the sensitivity, various attempts such as optical fluorescence, and PCR bio-sensor are in progress and chemical specificity and signal amplification of surface-enhanced LBL coating using ferrocene can improve accuracy. However, although ferrocene has excellent redox properties and reversibility, it is difficult to handle as an amphiphilic coating polymer due to its hydrophobic properties. We can overcome these difficulties through the synthesis of amphiphilic polymers using PEG. Second, Bacterial infection and biofilm formation of surfaces and other biomolecules present on the sensor can generate unwanted signals. To improve selectivity in such a complex biological environment, antibiofouling effect can be obtained by using PEG. Third, in order to control the reproducibility, a method for improving through LBL coating rather than general polymer-based coating was proposed. Multifunctional multilayer films based on ferrocene polymers are formulated to improve biocompatibility while maintaining its antifouling effects, and Layer-by-layer deposition is optimized to achieve the formation and self-assembly of dense and stable films. Combined with LBL system, this study has great potential for use as an anti-biofouling biosensors for other viruses in the future.