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Aim and Scope (목표와 범위)

: 저널이 커버하는 전문 분야와 편찬 의도의 명확성

An example

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All issues

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Volume 53

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Pages 1-388 (January–February 2022)

Research article • Full text access

A seed-like hydrogel with metabolic cascade microbiota for oral treatment of liver failure

Di-Wei Zheng, Ke-Wei Chen, Jian-Hua Yan, Zhi-Yong Rao, ... Xian-Zheng Zhang
Pages 30-40

Download PDF Article preview

Abstract Graphical abstract

Abstract

Liver failure is a fatal disease with a mortality rate of 80%. The only access to treat liver failure is invasive operation, which is restricted by limited donor sources or high costs. Thus, non-invasive medication for liver failure is urgently needed. Herein, we tried the first attempt to design a seed-inspired hydrogel with a micro-ecosystem, which imitates characteristics of seed with high intestinal adaptability, for the elimination of harmful metabolites in liver failure using a cascade reaction triggered by encapsulated microbes. Focusing on abnormal ammonia assimilation and intestinal oxygen metabolism, a two-component artificial microbiota was constructed to enable efficient intestinal oxygen consumption and subsequent hypoxia-induced ammonia elimination. More importantly, we imitated plant seeds with high adaptability to the intestinal environment to improve

Research article Full text access

A seed-like hydrogel with metabolic cascade microbiota for oral treatment of liver failure

Di-Wei Zheng, Ke-Wei Chen, Jian-Hua Yan, Zhi-Yong Rao, ... Xian-Zheng Zhang Pages 30-40

Abstract Graphical abstract

Graphical abstract

A seed-like hydrogel with metabolic cascade microbiota was demonstrated to achieve efficient oxygen consumption and cascaded hypoxia-induced ammonia elimination, which can reduce hepatotoxic endotoxin and neurotoxic ammonia in situ in the non-invasive treatment of liver failure.





Guide for authors (저자를 위한 안내)

: 메뉴스크립트 준비에서 제출, 심사 및 프루프 리딩에 이르기까지 전반적인 상세한 안내 메뉴스크립트 템플릿이 제공되면 저자들에게 편리함

An example (material today)

• Types of article	• Role of the funding source	• Artwork
Editor selection and invited articles	Open access	• Tables
Alternative mublications	• Submission	• References
Alternative publications	Review article proposal	• Video
Submission checklist	PREPARATION	Data visualization
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: 출판된 논문에 대해 복수의 동료에 의한 외부 심사가 이루어지고 있는가? 논문 심사는 평균 얼마의 시간이 소요되며, 심사에 특별히 많은 시간이 소요되는 논문들이 얼마나 되는지?

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Limited authors (제한된 저자)

: 논문의 저자들이 한 나라 또는 한 기관에 치중되어 있지는 않는가? 소수의 저자들이 많은 논문을 출판하고 있지 않는가?

: 출판된 논문의 충실도와 일관성, 편집의 적절성(그래프 및 그림의 배치와 해상도 등)

Examples (material today vol. 58)

(a) Exfoliation

(b) Solution phase assembly

1. Ligand mediated assembly

2. Surface charge mediated

Attraction

Reputsion

Exfoliated MoS₂

Attraction

Reputsion

Reputsion

MoS₂-WSe₂ vdWH

Solution phase synthesis of van der Waals heterostructure (vdWite. Schematic representation of (a) Simultaneous exfoliation of bulk layered TMD and functionalization of exfoliated sheets with pyrene terminated thiol based ligand taking MoS₂ as an example, (b) solution phase synthesis via (1) ligand and (2) surface charge mediated assembly in random solution phase to form MoS₂-gaphene and MoS₂-WSe₂ heterostructure, respectively. The free pyrene end group of ligand on the surface of TMD interact with graphene through IT-II interaction in MoS₂-graphene heteroassembly, in MoS₂-WSe₂ heterostructure, both surface charge driven attraction and IT-II interaction in MoS₂-graphene heteroassembly, (c) Dissociation of ligand by simple plt change to form widWI.

temperature dependence of adsorption process is related to several thermodynamic parameters such as standard free energy (ΔG_{α}) , enthalpy, (ΔH_{α}) and entropy (ΔS_{α}) of adsorption and were calculated using the following equations:

$$\ln b = -\frac{\Delta H^{\circ}}{RT} + \frac{\Delta S^{\circ}}{R}$$
(2)

where R is the universal gas constant, T is the temperature and b is the Langmuir constant. The values of AH^a and ΔS^a were calculated from the slope and intercept of the plot of $\ln b$ versus 1/T, respectively. The positive value of AH^a (3.8 kJ/mol) confirm the endothermin nature of alsoproin. The negative value of ΔG^a at different temperatures (Table 51) indicates the spontaneous nature of ligand adsorption on to bulk MoS_b. The positive value of ΔS^a (11.2 J/mol/S) suggests the increased randomness at the solid/solution interface during the adsorption. Interestingly, pysene excimes are found to dissociate to monomers ≥ 30 °C and would be the reason for enhanced adsorption rate of ligands to

Due to the layered structure, we can envisage the adsorption of thiol terminated ligands in to not only the surface but also the interlayer of MoS₂ via Lewis add base interaction. The fluffy nature of L₁-L₈ intercalated MoS₂ is evident from the scanning electron microscopy (EM) and atomic force microscope (AFM).

morphology analysis (Supplementary Fig. S4). As evident from the AFM height analysis, the La intercalated MoSa has relatively smaller number of sheet thickness indicating that the long dangling alkyl chains of L3 provide sufficient physical gaps to alleviate the van der Waals interactions among the MoS, layers. As a consequence, the MoS2 layer-layer interaction get weakened leading to an effective exfoliation. The progress of exfoliation is monitored by UV-visible spectroscopy, where the absorption peaks at 674 nm and 746 nm correlate to the amount to exfoliated MoS2 and WSe2 in dispersion, respectively (Supplementary Fig. S5). As shown in Fig. S5, the rate of exfoliation became saturated after 5 h of ultrasonication and is higher with Lo compared to L2 and L1 for both MoS2 and WSe2. This suggests the vital role of alkyl chain length in ligands for disrupting the interlayer van der Waals force while providing the extra pulling effect to exfoliate sheets from the TMD flakes under sonochemical treatment. In addition, the exfoliated TMDs using L3 display an extended period of colloidal stability (>1 year) due to the sufficient surface functionalization by the ligands, which in turn provides a steric effect for preventing the aggregation of exfoliated nanosheets.

The main advantage of modified LPE process is the optimized interaction of ligands which allow significant exfoliation upon mild sonication procedure resulting in lesser destruction of nanosheets. As a result, a comparably high yield of exfoliated nanosheets (23%) of size upto 225 µm is achieved (Supplementry Rg. Sol., Interestingly, a control experiment following the

micro-electroosmosis [39], micro-plasma production [40], electrostatic spinning [41] as well as droplet manipulation [18,42– 46]. The common methods for human-motion divers droplets.

46]. The common methods for human-motion-driven droplets manipulation are based on the action of electrostatic force and surface tension of the charged droplet, known as electrowetting [18,43,46] or electrostatic control mechanism [42,44,45].

Herein, we report a highly efficient droplet manipulation system using a direct charge injection (DCI) method. In the driving process, via the triboelectrification between two dissimilar materials, a large number of charges could be directly injected into the droplet through interface contact between the liquid and the electrode, providing a strong electric field which can be used to drive the movement of droplets. As a result, the charge quantity injected into the droplet (10 µL) increases from 0.03 nC to 0.25 nC, with the average movement velocity reaching 255 mm s-1, over 6 times higher than that of traditional methods (43.2 mm s-3). Furthermore, by designing an alternative charge injection process, the droplets can achieve reciprocating motions on the horizontal surface and jumping motion in the vertical direction. Based on these characteristics, we designed a droplet manipulation platform that integrates droplet transportation, positioning, physical reactivity, and self-cleaning capabilities. This work is bringing a new strategy to the current droplet manipulation field via human-motion-induced direct

Results and discussion

Motion-droplet interaction platform

The fundamental mechanism for droplet driving relies on electrostatic force. Consequently, both electric field and charge quantity are important for high efficiency manipulation. Previous droplet manipulations using TENG were largely based on the electrowetting method [18,43,46]. Although the electric field produced by TENG could be strong, the charge quantity on the droplet formed by triboelectrification of the liquid-solid interface was small [47-51], largely compromising droplet driving efficiency. In this work, we developed the prototype of a highly efficient droplet manipulation system, using a DCI method. As the 3D schematic shown in Fig. 1a, the system comprised a TENG device, a HV rectifier module, and a droplet movement platform. Specifically, one electrode used for the movement platform was located between an insulating and a hydrophobic layer, with a small edge exposed so as to contact the droplet directly and implement DCI to the droplet (In set of Fig. 1a). In this work, for consistency, a free-standing (FS) mode TENG with length, width, and thickness of 150, 100, and 8 mm was trialed for all experimental measurements and demonstrations. To generate a higher surface charge density, the surface of the polytetrafluoroethylene (PTFE) friction layer was etched into nanostructures (scanning electron microscope (SEM) image shown in Fig. 1b). The maximum open-circuit voltage and short-circuit charge out-

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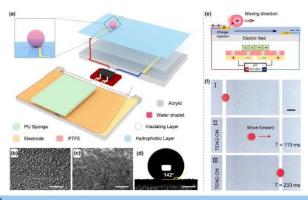


FIGURE :

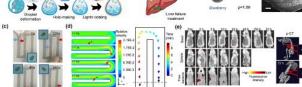
Prototype of the high efficiency motion-droplet manipulation platform. (a) 3-D schematic diagram of the basic droplet driving platform composed of a TENG a high-vohlage recifier module and a droplet motion part. The enlarged area shows the exposed electrode edge for charge injection. (b) Surface morphology of the hydrophobic layer (scale bar. 20 mg.) (c) Two control of the PTEF tibo caper (scale bar. 20 mg.) (c) Two control of the order to the hydrophobic surface (scale bar. 1 mm.) (e) The mechanism of DC method for driving a droplet by human-motion. (i) Photographs of the droplet movements via human-motion induced direct charge injection, (scale bar. 2 mg.)

DESEABOR

Materials Today • Volume 58 • September 2022

RESEARCH: Original Rese

(a) Barry C bulgroum E subtre C H₁₀O₂+H₂O₂+D₂ Subtre CO₂+H₃O Subtre CO₃+H₃O Subtre CO₃+H



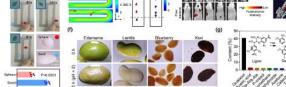


FIGURE 1

Advantages of seed in intestinal delivery, (a) Schematic disagram of the design of artificial microbious and the preparation of SBME for alleviating liver failure δ_0 SBM images and photos of the seed from various benies, (a) Movement of seed shapped and spherical particles in a 5-type tank (n=5), (e) h vivo fluorescence images of the retention of DBME tabeled seed-shapped particles, spherical particles in a 5-type tank (n=5), (e) h vivo fluorescence images of the retention of DBME tabeled seed-shapped particles, spherical particles, and bacteria in rat intensite. The location of the particles in the intestine or confirmed by μ CFM intensity (n=4). Significance between each group was calculated with two-tailed Student's f-test. Data are mean \pm s.d., and nepteresents the number of biologically independent samples. If Photos of different plant seeds before and after the acid treasurement, [g) PyCCMO 5 of the material composition in the seeds of berfere

36.3 mm g⁻¹, respectively. To increase the resistance of acachieved hydrogel in complex digestive systems, sodium lignosulfonate was further coated on the surface of hydrogel particle as a biomimetic lignified shell through the alternative layer-by-layer assembly with polyallylamine hydrochloride (PAH). It was found that changing the concentration of raw materials, such as sodium alginate, bateria and CaCO₃ microsphere did not affect the morphology of SBME. However, high calcium chloride concentration (19%) caused gel particles to adhere into double beads, bead chairs or filaments. Additionally, the morphology of SBME did not change obviously during 7 days of storage (Supnementative Ref. 3)

As shown in Fig. 2e, mcherry-expressing Escherkhia coll (E. coli) was evenly distributed in the green fluorescent hydrogel particles. A polymer membrane labeled with coumarin was observed. SEM observation demonstrated the presence of CaCO₃ microspheres in micro-hydrogel particles (Supplementary Fig. 3). After the acid treatment, CaCO₃ microspheres disappeared and bacteria green in the provious structure of hydrogel particles (Fig. 2f). It was observed that the wall was a dense structure with a thickness of about 10 μm (Fig. 2g). The porous structure of hydrogel particles was discontinuous with the wall. Statistical analysis showed that SBME particles had an average long axis and a width axis of 715 and 443 μm , respectively (Fig. 2h). The