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编者按

经学校申报、专家组考察评估、市领导研究，我校被定位为北京市重点建设的**高水平研究型大学**，学校的教育事业发展进入了新阶段。学校将以此为契机，以高水平科研平台建设、科研项目申报、科研成果获批为导向，提升科研创新能力，推动科技成果转化，为实现具有商科、轻工和食品特色的世界一流大学不懈努力，力争为国家和首都经济社会发展做出新的更大贡献。

为激发全校师生的科研热情，展示学校各类高水平科研成果，科学技术处、党委宣传部推出**《学术简报》**栏目，在栏目中推送各学科的最新科研成果，以便师生全面、准确了解各学科科研发展状况，促进各学科间相互交流与合作，推动学校整体科研工作水平的整体、稳步提升。

数学与统计学院李丹在国际知名期刊发表学术论文

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AN UPBOUND OF HAUSDORFF'S DIMENSION OF THE DIVERGENCE SET OF THE FRACTIONAL SCHRÖDINGER OPERATOR ON $H^s(\mathbb{R}^n)$*

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Abstract Given $n \geq 2$ and $\alpha > \frac{1}{2}$, we obtained an improved upbound of Hausdorff's dimension of the fractional Schrödinger operator; that is,

$$\sup_{f\in H^s(\mathbb{R}^n)} \dim_H \left\{x \in \mathbb{R}^n : \lim_{t\to 0} e^{it(-\Delta)^\alpha} f(x) \neq f(x)\right\} \leq n+1-\frac{2(n+1)s}{n}$$

for $\frac{n}{2(n+1)} < s \leq \frac{n}{2}$.

Key words The Carleson problem; divergence set; the fractional Schrödinger operator; Hausdorff dimension; Sobolev space

2010 MR Subject Classification 42B37; 42B15

该论文主要应用波包分解、decoupling和refined Strichartz估计等方法，其中decoupling理论和refined Strichartz估计分别是Bourgain-Demeter和Du-Guth-Li近五年发表在数学著名四大期刊Annals of Mathematics上的结果。本论文应用上述方法得到了分数次Schrödinger算子发散点集Hausdorff维数的上界估计。该期刊在数学领域高质量科技期刊分级中属于数学类T2期刊，位列Q2区。

食品与健康学院李赫副教授和刘新旗教授关于大豆蛋白衍生肽对益生菌和肠道菌群影响的研究成果

1）2021年4月，国际期刊《Food & Function》发表了刘新旗教授课题组题为《Different effects of soybean protein and its derived peptides on the growth and metabolism of Bifidobacterium animalis subsp. animalis JCM 1190》的研究论文。

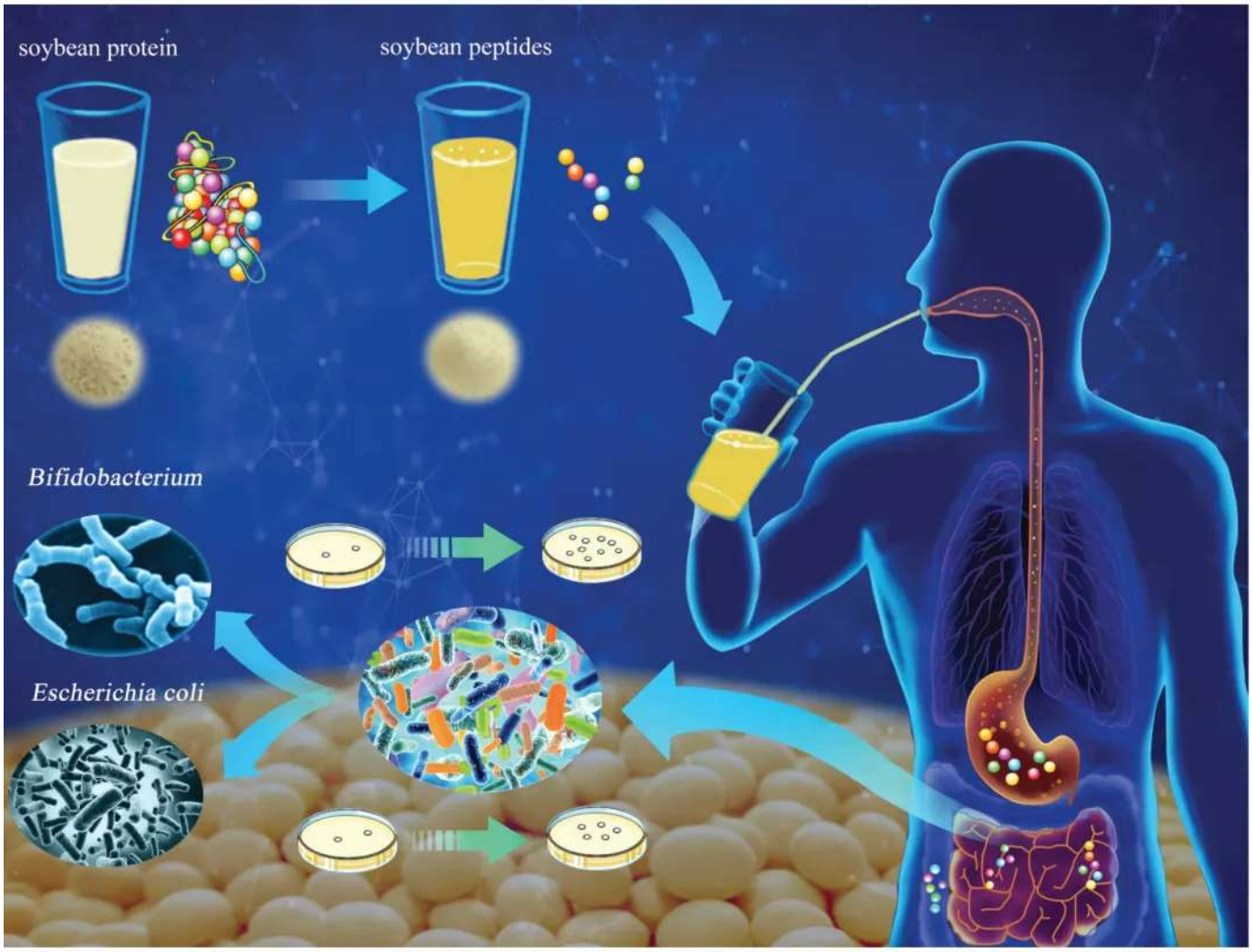
本研究旨在探讨大豆蛋白和大豆肽对动物双歧杆菌动物亚种JCM 1190生长和代谢的不同影响。检测单培养（动物双歧杆菌动物亚种JCM 1190）和共培养（动物双歧杆菌动物亚种JCM 1190和大肠杆菌JCM 1649）期间的活菌数、pH、乳酸和乙酸含量，并利用非靶标代谢组学的研究方法寻找差异代谢物和代谢通路。大豆蛋白和大豆肽促进了动物双歧杆菌动物亚种JCM 1190的生长和代谢，而消化大豆肽有较好的促进作用。在单培养中，消化大豆肽通过调节甘氨酸、丝氨酸和苏氨酸代谢，以及丙酮酸代谢、TCA循环、糖脂代谢和其他代谢途径，增加了单培养中的活菌数、乳酸和乙酸含量。在共培养中，消化大豆肽平衡了早期动物双歧杆菌动物亚种JCM 1190和大肠杆菌JCM 1649利用氮源的能力，并增强了后期动物双歧杆菌动物亚种JCM 1190在共培养中的竞争力。

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ROYAL SOCIETY OF CHEMISTRY

PAPER

He Li, Xinqi Liu *et al.*

Different effects of soybean protein and its derived peptides on the growth and metabolism of *Bifidobacterium animalis* subsp. *animalis* JCM 1190

Food & Function

ROYAL SOCIETY OF CHEMISTRY

PAPER

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Different effects of soybean protein and its derived peptides on the growth and metabolism of *Bifidobacterium animalis* subsp. *animalis* JCM 1190†

Wenhui Li, He Li,* Yinxiao Zhang, Lijuan He, Chi Zhang and Xinqi Liu*

Bifidobacterium is a common probiotic that plays a vital role in the intestinal tract. This study aimed to explore the different effects of soybean protein and soybean peptides on the growth and metabolism of *Bifidobacterium animalis* subsp. *animalis* JCM 1190. Soybean protein and soybean peptides were digested *in vitro*, after which different nitrogen source containing media were prepared and used for the monoculture of *Bifidobacterium animalis* subsp. *animalis* JCM 1190 and the co-culture of *Bifidobacterium animalis* subsp. *animalis* JCM 1190 and *Escherichia coli* JCM 1649. During the culture process, the viable cell number and lactic acid and acetic acid contents were measured, while non-targeted metabonomics was used to detect the differential metabolites and metabolic pathways. The results showed that soybean protein and soybean peptides promoted the growth and metabolism of *Bifidobacterium animalis* subsp. *animalis* JCM 1190, while digested soybean peptides had a better effect. Digested soybean peptides increased the viable cell number and lactic acid and acetic acid contents in the monoculture by regulating glycine, serine, and threonine metabolism, as well as pyruvate metabolism, the TCA cycle, glycolipid metabolism, and other metabolic pathways, balanced the ability of *Bifidobacterium animalis* subsp. *animalis* JCM 1190 and *Escherichia coli* JCM 1649 to utilize nitrogen sources during the early period and enhanced the competitiveness of *Bifidobacterium animalis* subsp. *animalis* JCM 1190 during the later period in co-culture.

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1. Introduction

Soybean protein (Pro) is a high-quality plant protein that contains all the essential amino acids for human health, while also exhibiting an excellent balance in amino acid composition.[1] It also displays biological activity that can reduce cholesterol, prevent cardiovascular disease, and more.[2,3] In addition, Pro also exhibits excellent processing ability, such as gelation, emulsification, and water and oil retention.[1] Pro can be transformed into soybean peptides (Pep) after enzymolysis, separation, and purification, and the amino acid composition of Pep is similar to that of Pro. Moreover, the physicochemical and functional properties of Pep are more extensive, making it easy to dissolve and absorb while exhibiting a hypotensive, hypolipidemic, and antioxidative effect.[4–6] To date, it has been widely used in food, health products, and other industries.

Bifidobacterium is one of the most common microorganisms in the intestines of newborns and infants and is an essential probiotic in healthy human intestines.[7,8] *Bifidobacterium* can produce lactic acid and acetic acid, release bacteriocin, adhere to the intestinal epithelium, and enhance the intestinal epithelial barrier where it plays a role in antioxidant, hypoglycemic, and immune function regulation while preventing intestinal diseases.[9–14] Due to these functional characteristics, *Bifidobacterium* is widely used in fermented milk products, and studies have shown that it is not only highly tolerant to oxygen and acidic environments, but also can remain stable during the storage process.[15]

Bifidobacterium is deficient in nitrogen and needs to absorb exogenous nitrogen sources to gain energy. Minimal studies are currently available involving the proteolytic system of *Bifidobacterium*. It has been proven that the cell and cell wall binding protein components of *Bifidobacterium* cannot hydrolyze casein, leading to low growth in milk.[16] However, a combination of intracellular *Bifidobacterium* proteolytic enzymes can hydrolyze casein rapidly. Some studies have identified and

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原文链接：Wenhui Li, He Li*, Yinxiao Zhang, Lijuan He, Chi Zhang, Xinqi Liu*. Different effects of soybean protein and its derived peptides on the growth

and metabolism of Bifidobacterium animalis subsp. animalis JCM 1190. Food & Function, 2021, 12(13), 5731-5744.
DOI: 10.1039/D1FO00480H

2）2021年11月，国际期刊《Journal of Food Science》发表了刘新旗教授课题组题为《Differences in the gut microbiota composition of rats fed with soybean protein and their derived peptides》的研究论文。

本研究旨在研究SD大鼠肠道微生物群对大豆蛋白及其衍生肽的利用差异。通过16S rDNA扩增子测序测定大鼠盲肠微生物组成，在喂养35天后，大豆蛋白及其衍生肽显著增加了肠道微生物群的丰度和均匀性。尽管喂食大豆蛋白及其衍生肽的大鼠显示出相似的肠道微生物群结构，但大豆肽显著提升了乳酸杆菌、考拉乳杆菌、双歧杆菌等益生菌的比例。

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HEALTH, NUTRITION, AND FOOD

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Differences in the gut microbiota composition of rats fed with soybean protein and their derived peptides

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Abstract: Current studies regarding the effect of different nitrogen sources on gut microbiota have thus far disregarded the ability of probiotics and coliforms to compete for protein. This study aimed to investigate the differences in the utilization of soybean protein (SPro) and its derived peptides (SPep) by the gut microbiota of Sprague Dawley (SD) rats. The SPro and SPep prepared in this study showed extensive SPro molecular weight distribution, while that of SPep was minimal, ranging between 150 and 1000 Da and primarily consisting of two to five amino acids. The cecum microflora composition of the rats was determined via 16S rDNA amplicon sequencing, showing that the SPro and SPep significantly increased the abundance and uniformity of the gut microbiota after 35 days of feeding. The *Firmicutes*/*Bacteroidetes* (F/B) ratios of the SPep, SPro, and casein groups were 2.49 ± 0.60, 2.98 ± 1.12, and 2.59 ± 0.74, respectively. Although the rats fed with SPro and SPep displayed similar gut microbiome structures, SPep significantly promoted *Lactobacillus* and *Phascolarctobacterium* growth. The results showed that SPep significantly increased the diversity of the gut microbiota and elevated the probiotic proportion.

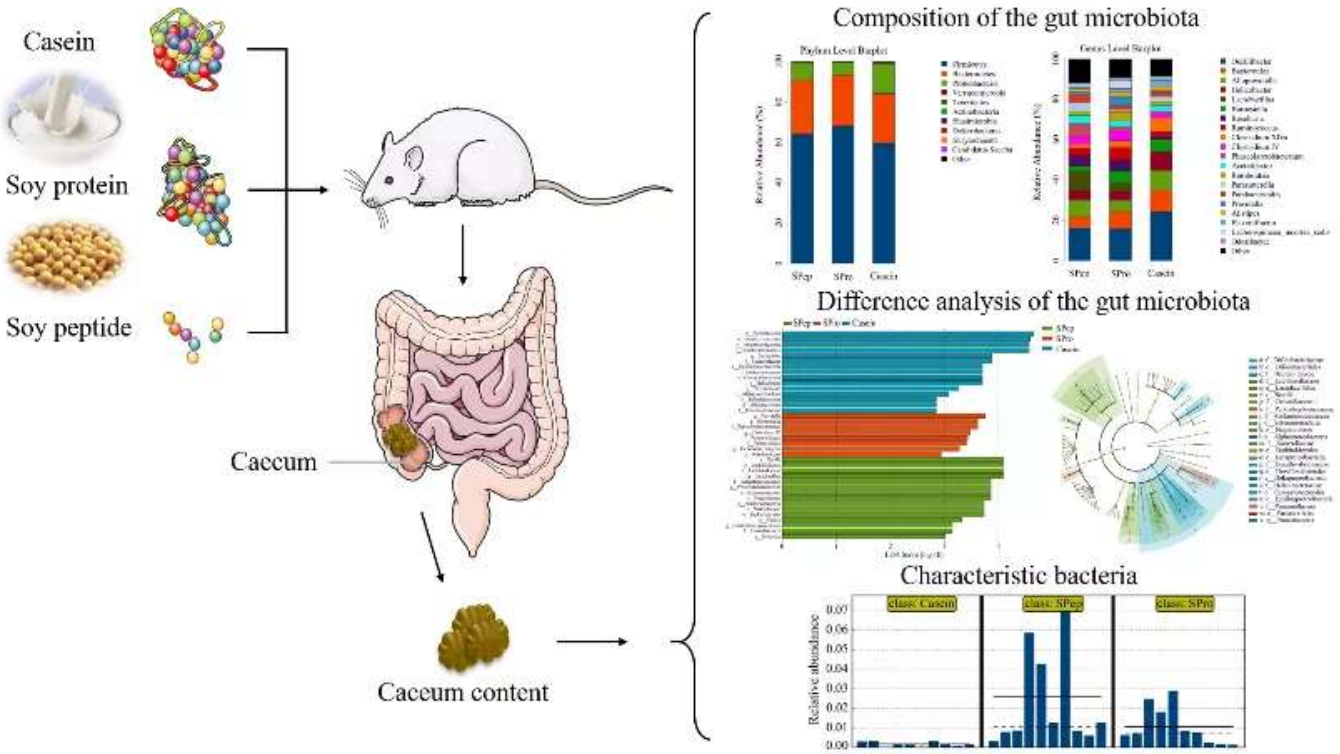
Practical Application: SPro and SPep are two nutritious and high-quality nitrogen sources. The results showed that SPro and SPep regulated the structure of gut microbiota in rats, and the effect of SPep was better. This study provides a theoretical basis for developing SPep functional foods able to regulate gut microbiota and maintain health.

KEYWORDS
gut microbiota, nitrogen source, soybean peptides, soybean protein

1 | INTRODUCTION

The number of microorganisms in the human intestine exceeds the cells in the body by about 10-fold and primarily consists of bacteria, archaea, fungi, protozoa, and viruses (Bäckhed et al., 2005; Claesson et al., 2012). The vast number of gut microbiota is considered a microbial organ essential in protecting health and treating disease (Gilbert et al., 2018). Gut microbiota dysbiosis manifests via structural and functional changes, a decline in species richness, and pathogenic bacterial proliferation, ultimately leading to related metabolic diseases, such as obesity, cancer, inflammatory bowel disease, and other associated disorders (Postler & Ghosh, 2017; Y. J. Zhang et al., 2015). Therefore, maintaining gut microbial balance and increasing the proportion of probiotics are crucial.

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化学与材料工程学院樊保民副教授发表高水平学术论文

樊保民副教授在国际著名期刊《Journal of Industrial and Engineering Chemistry》上发表表面腐蚀相关的学术论文《Electronic effects on protective mechanism of electropolymerized coatings based on N-substituted aniline derivatives for mild steel in saline solution》。

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Electronic effects on protective mechanism of electropolymerized coatings based on *N*-substituted aniline derivatives for mild steel in saline solution

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ABSTRACT

Polyaniline (PANI), poly(*N*-methylaniline) (PNMA) and poly(*N*-formylanilide) (PNFA) coatings were fabricated over mild steel via chronoamperometric strategy in oxalate electrolyte. Scanning electron microscope (SEM), attenuated total reflection infrared spectroscopy (ATR-IR) and X-ray photoelectron spectroscopy (XPS) evidenced the polymerization of monomers. Anticorrosive effects of PANI, PNMA and PNFA coatings for steel substrate were evaluated during long-term immersion in 3.5% NaCl solution by potentiodynamic polarization, electrochemical impedance spectroscopy (EIS) and frequency modulation (EFM). Morphological variation for coated specimens before and after immersion in NaCl solution was also monitored by SEM and atomic force microscope (AFM). Differentiated protection capability were observed for three coatings following the sequence of PNFA > PNMA > PANI. Through electrochemical and interfacial analyses, electroactivity and physical barrier were ascertained as the critical factors, especially the former one, in the long-term protection capacity. Electroactivity was distinguished by the elevated apparent current density from non-destructive EFM measurements. Furthermore, electron-donation and -withdrawal effects of *N*-substituents played an essential role in coating electroactivity. In detail, *N*-substituents improved the anodic protection and physical barrier of PNMA and PNFA coatings. Particularly, formyl with electron-withdrawal effect reinforced the anodic protection and thus the superior the anticorrosion efficiency of PNFA for underlying steel.
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化学与材料工程学院嵇天浩教授、许柘宓副教授在《Nanoscale Advances》、《Materials Letters》发表两篇基于新型二维材料g-C3N4结合碳量子点异质结构改善液相光催化效能的文章



Nanoscale Advances

ROYAL SOCIETY OF CHEMISTRY

PAPER

Hydrothermally activated TiO_2 nanoparticles with a C-dot/g-C_3N_4 heterostructure for photocatalytic enhancement†

Zhong-yi Chen,[a] Tian-hao Ji,[*a] Zhe-mi Xu,[a] Peiyuan Guan[*b] and Da-jian Jv[a]

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rsc.li/nanoscale-advances

Dye degradation *via* photocatalysis technology has been investigated intensively to tackle environmental issues and energy crisis concerns. In this study, a newly designed ternary photocatalyst was facilely prepared by a simple one-pot hydrothermal process by directly mixing TiO_2 nanoparticles with carbon dots (C-dots) and graphitic carbon nitride (g-C_3N_4). The optimized precursor treatments and heterostructure components show significantly enhanced photodegradation activity towards organic dyes Rhodamine B (RhB) and methylene blue (MB). Excellent photocatalytic activities were achieved owing to the better attachment of anatase-type TiO_2 nanoparticle-aggregations to the C-dots/g-C_3N_4 (CC) nanocomposite, which impressively displays superhydrophilicity by employing the hydrothermal activation process. FT-IR spectra revealed that the hydrothermal treatment could remarkably increase the coupling interactions between TiO_2 nanoparticles and the CC nanosheets within the ternary catalyst, enhancing the photocatalytic activity. Thus, it was concluded that this ternary photocatalyst is highly suitable for the remediation of dye-contaminated wastewater.

污水处理行业对全球温室气体的总贡献率虽然仅占2%～5%，但亦不可小觑，面对碳减排甚至碳中和的压力，高效的污水处理体系对碳中将有非常积极的作用。TiO2因其稳定性高、氧化能力强且无毒在污染物降解光催化体系中是非常重要的功能材料。然而其带隙较大，光吸收范围相对较小，限制了其在可见光范围光催化的应用。本文通过水热一步法制备了高效的“TiO2/Carbon-dot/g-C3N4”异质结构，有效拓展了TiO2的吸光波长，提升了其光利用率。同时，该结构能够更有效的提升光致自由基的产生，抑制TiO2电子-空穴对的复合，实现了光催化效率的大幅提升。该成果于2021年5月被报道《Nanoscale Advances》杂志。

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The critical role of surface area optimization in carbon quantum dots modified g-C_3N_4 for photocatalytic enhancement

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ABSTRACT

G-C_3N_4 has shown great potential in photocatalytic degradation. However, the layered structure of g-C_3N_4 may prevent the contaminant adhesion in the interlayers, which greatly limited its active surface area for photocatalysis. Herein, a simple and fast hydrothermal process was optimized: with appropriate synthesis temperature, carbon dots dispersed into the interlayer of g-C_3N_4 without destroying the frame structure, opened the layer distance of g-C_3N_4, enlarged its surface area by 3.56 times, and enhanced its photoresponse and photoredox capacity significantly. Excellent photocatalytic activities were observed towards organic dyes Rhodamine B (RhB). This work provides a new approach to optimize the layered g-C_3N_4 via surface area modification, which enhanced the design and fabrication of a g-C_3N_4-based photocatalyst.

Journal Pre-proofs

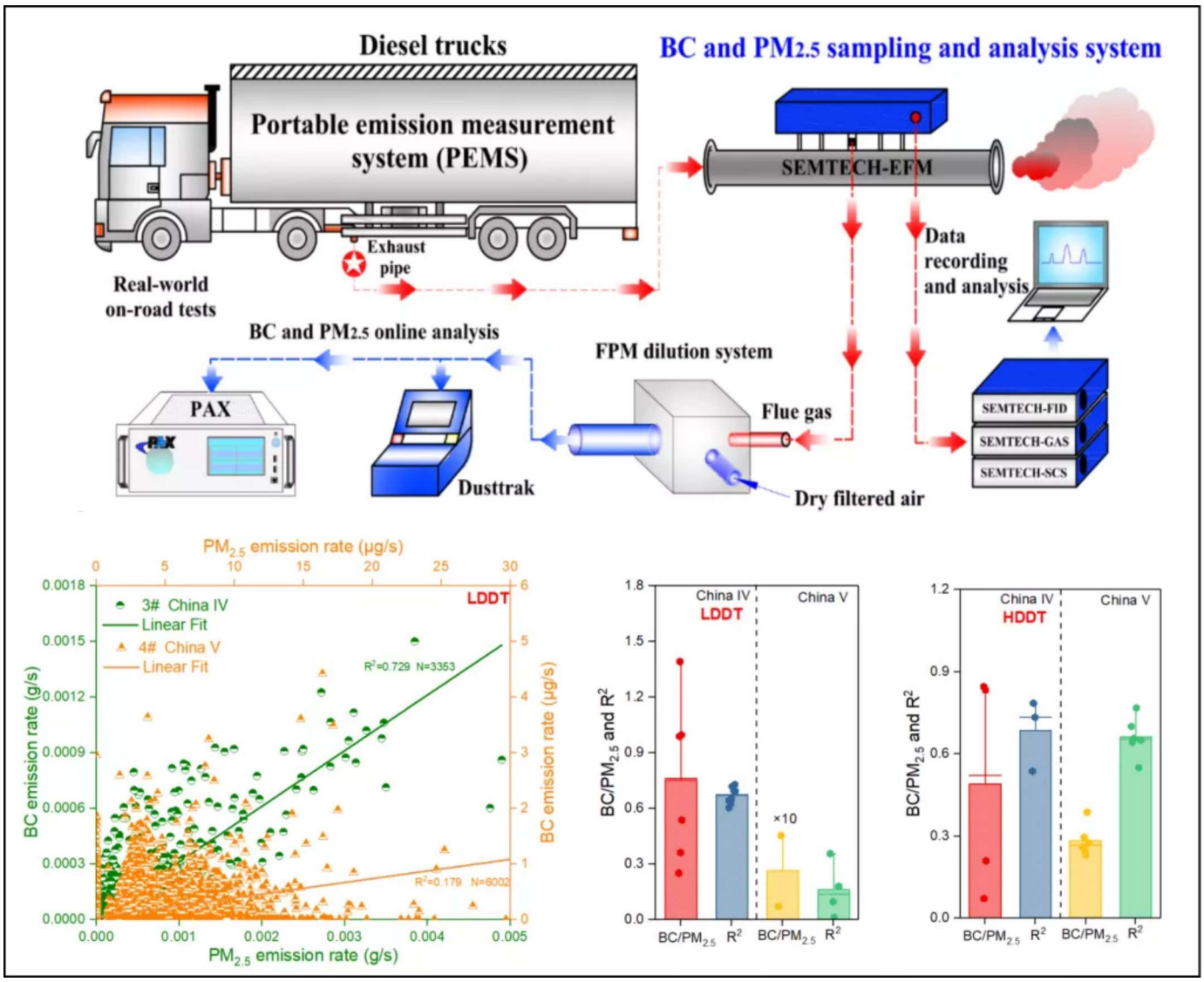
g-C3N4是一种独特的2D层状非金属材料，其能带结构非常适合光催化分解气相与液相污染物，同时g-C3N4兼具合成方法简便、热稳定性良好等优点，因此被普遍视为具有广阔应用前景的光催化材料，在光催化分解水产氢、人工光合成、有机污染物降解以及二氧化碳还原等领域具有重要的研究价值。然而，作为典型的层状材料，其因层间距过小，导致目标降解物难以吸附于层间，使层间不能被有效利用，大幅降低了污染物可吸附的有效表面积。本文通过水热法合成碳量子点，使其有效打开了g-C3N4的层间距，增大其原有表面积3.56倍，大幅提升了g-C3N4的光催化性能。该文章已于2021年11月被《Materials Letters》杂志接收。

原文链接：DOI: 10.1016/j.matlet.2021.131273

生态环境学院城市大气复合污染与控制团队在《Science of the Total Environment》（IF：7.963）上发表柴油车黑炭（BC）排放特征研究成果

近日，城市大气复合污染与控制团队在《Science of the Total Environment》（IF：7.963）期刊上发表题为《Real-world emission characteristics of black carbon emitted by on-road China IV and China V diesel trucks》的文章。

柴油车是黑炭(BC)排放的重要来源。城市大气复合污染与控制团队搭建了由光声消光仪和SEMTECH-LDV组成的便携式排放测量系统，测试了14辆国IV和国V排放标准的轻型和重型柴油车在北京实际行驶过程中的BC排放。获得了BC排放因子和BC/PM2.5比值，分析了车型、排放标准和行驶工况对排放的影响。研究结果表明：随排放标准的加严和汽车技术的进步，BC排放也迅速下降。从国II 到国IV标准，BC的减排量低于PM2.5的其他组分，但从国IV到国V标准，BC减排量高于其他组分。对重型柴油车（HDDTs）和国IV轻型柴油车（LDDTs），BC和PM2.5具有相同的主要来源，但安装DPF的国V LDDTs却有不同来源。从国IV国V标准，LDDTs和HDDTs的BC/PM2.5比值分别下降了97.2%和38.2%。国V LDDTs的BC/PM2.5比其他柴油车低10 - 20倍。高速工况下的BC排放比城市道路低39.4%±16.7%，但BC/PM2.5的比值呈相反趋势。为了获得更准确的BC/PM2.5数据，并提高排放清单计算的准确程度，需要测试更多配备DPF的国V型和中国VI型重型柴油车辆。本研究结果有助于认清实际道路上柴油车BC排放特征，为制定我国柴油车排放控制策略提供科学依据。



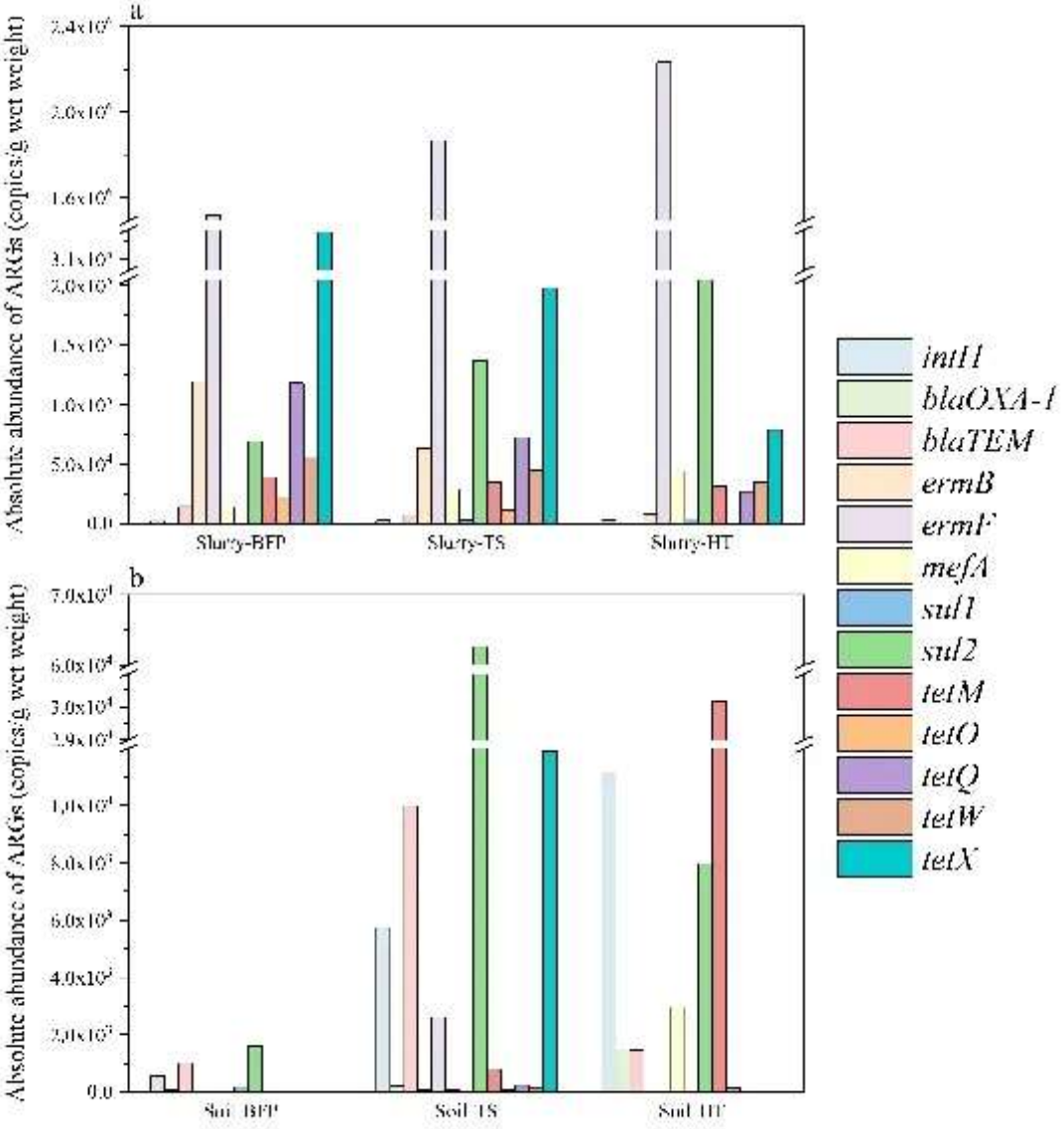
本文第一作者为生态环境学院申现宝副教授，通讯作者为生态环境学院姚志良教授；该研究工作受到国家自然科学基金（(41775126)）和北京市杰出青年基金(No. JQ19030）等项目资助。

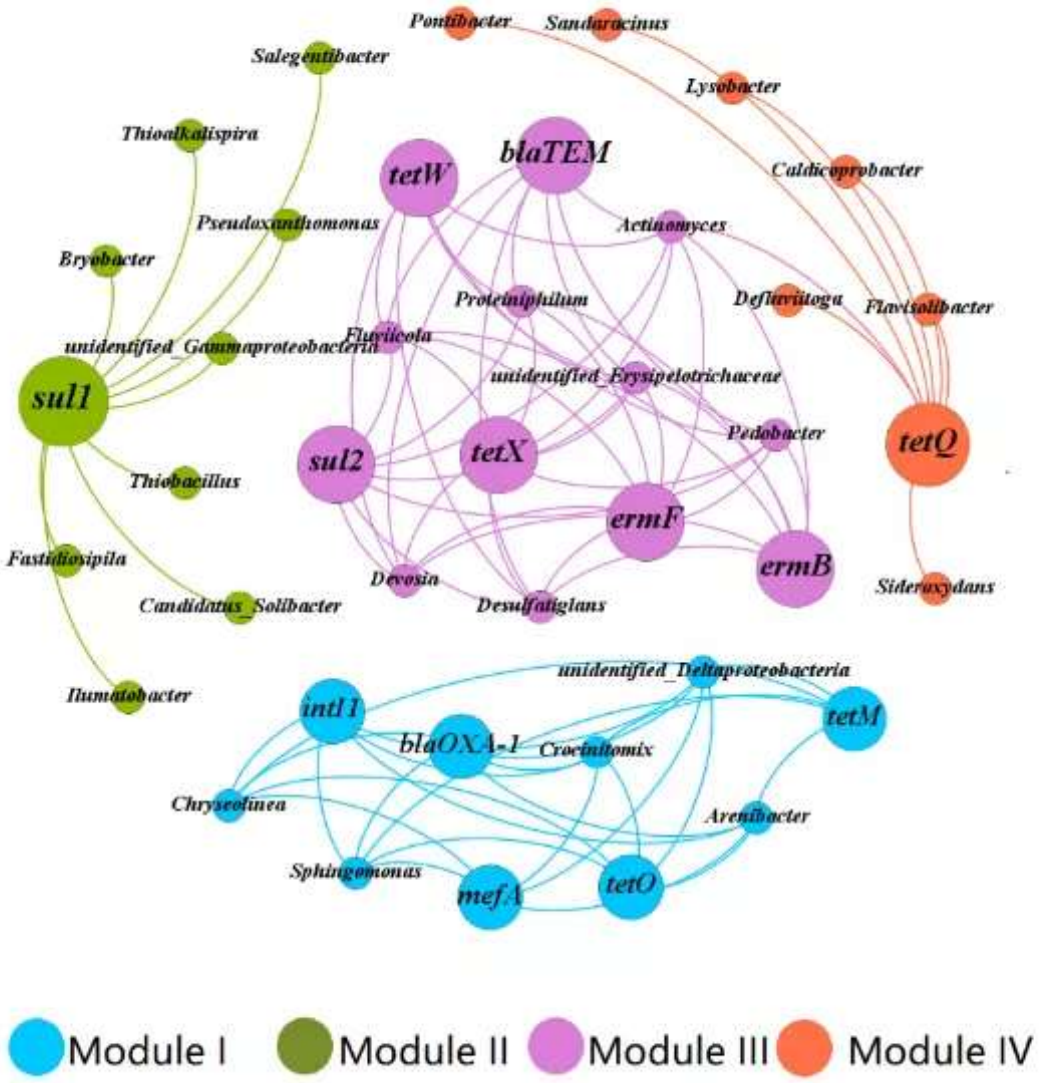
原文信息：Shen, X., Lv, T., Zhang, X., Cao, X., Li, X., Wu, B., Yao, X., Shi, Y., Zhou, Q., Chen, X., Yao, Z., 2021. Real-world emission characteristics of black carbon emitted by on-road China IV and China V diesel trucks. Sci. Total Environ. 799, 149435. https://doi.org/10.1016/j.scitotenv.2021.149435.

生态环境学院固体废弃物处理与处置团队在《Environmental Science and Pollution Research》（IF：4.223）上发表关于餐厨垃圾厌氧发酵过程中抗生素抗性基因行为归趋及沼液施用对土壤抗生素抗性基因影响的研究成果

固体废弃物处理与处置团队在《Environmental Science and Pollution Research》（IF：4.223）期刊上发表题为《Characteristics of antibiotic resistance genes in full-scale anaerobic digesters of food waste and the effects of application of biogas slurry on soil antibiotic resistance genes》的文章。

抗生素抗性基因（Antibiotic Resistance Genes, ARGs）作为一种新型环境污染物其危害在于可以通过水平基因转移使致病菌获得抗性，从而导致抗生素失效，严重威胁人类健康。固体废弃物处理与处置团队在全国多地典型餐厨垃圾处理工程的厌氧反应器内检测到了多种ARGs。但湿热预处理，尤其是超临界水预处理可以有效去除餐厨垃圾中的ARGs，超临界水预处理可将总ARGs的绝对丰度去除99%。沼液作为厌氧发酵后的产物通常作为肥料施用于农田，用以改善土壤质量达到作物增产的目的。本文研究表明，沼液直接施用于农田土壤中虽可提高土壤营养成分含量（包括总氮、碱解氮、总磷和有效磷等），但可能导致ARGs在土壤环境中的传播。本研究重点研究了不同餐厨垃圾预处理过程和餐厨垃圾厌氧发酵过程对去除中抗生素耐药基因(ARGs)的影响，并研究了沼液施用对土壤中ARGs丰度的影响，沼液改善土壤养分的同时使几种ARGs（sul2、tetM、blaOXA-1、blaTEM）和intI1在土壤中丰度升高。本研究为餐厨垃圾厌氧发酵过程中ARGs的去除和沼液施用于农田的风险评估提供重要信息。


a
b
Absolute abundance of ARGs (copies/g wet weight)
Slurry-BFP
Slurry-TS
Slurry-HT
Soil-BFP
Soil-TS
Soil-HT
intI1
blaOXA-1
blaTEM
ermB
ermF
mefA
sul1
sul2
tetM
tetO
tetQ
tetW
tetX



本文第一作者为生态环境学院王攀教授，通讯作者为生态环境学院任连海教授；该研究工作受到国家自然科学基金（42007350）、国家重点研发计划项目（2019YFC1906303）和北京市自然科学基金（8202010）资助。

原文信息：Wang, P., Zheng, Y., Lin, P., Chen, X., Qi, L., Yang, X., Ren, L. 2021. Characteristics of antibiotic resistance genes in full-scale anaerobic digesters of food waste and the effects of application of biogas slurry on soil antibiotic resistance genes. Environ Sci Pollut Res.

人工智能学院李熊副教授发表高水平学术成果

有机太阳电池具有成本低、易于制备柔性器件、可通过喷涂、roll-to-roll等工业化方法大面积制膜，有望在解决能源问题上发挥重要作用，近年来成为世界范围内的研究热点。目前制备的高效有机太阳能电池普遍使用氯苯、氯苯等卤化溶剂，卤化溶剂的高毒性不利于有机太阳电池的商业化制备。使用非卤溶剂或减少氯溶剂的使用是有机光伏器件绿色化制备的一个重要研究方向。

李熊研究小组在PM7:IT-4F非富勒烯有机太阳能电池的研究中，使用非卤溶剂邻二甲苯（OX）作为主溶剂，引入少量（10%）含氯溶剂二氯甲烷（DCM）作为客体溶剂，混合溶剂改善了活性层的结晶，优化的活性层形貌抑制了载流子复合，改善了电荷输运，把有机太阳电池的能量转换效率从10.21%提高到12.74%。该研究工作显著减少了卤化溶剂的使用，提供了一种绿色制备有机太阳电池的有效的方法。该工作以“Improved Charge Transport and Reduced Carrier Recombination of Nonfullerene Organic Solar Cells with the Binary Solvent”为题发表在国际著名期刊ACS Applied Energy Materials上。

原文链接：

Xue-jiao Zhou, Ting-ting Dai, Xiong Li*, Yu-jiao Yan, Wen Xiong, Tao Lin, Jun Zhou, Deng-hui Xu*, Yao-hui Zhu, Jia Zhao, and Ai-cong Geng. Improved Charge Transport and Reduced Carrier Recombination of Nonfullerene Organic Solar Cells with the Binary Solvent, ACS Appl. Energy Mater. 2021, 4, 8, 8175–8182

DOI: 10.1021/acsaem.1c01447

ACS APPLIED ENERGY MATERIALS

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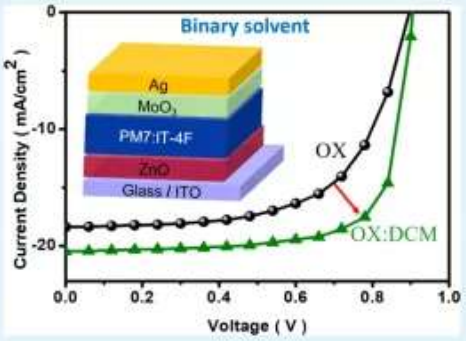
Improved Charge Transport and Reduced Carrier Recombination of Nonfullerene Organic Solar Cells with the Binary Solvent

Xue-jiao Zhou, Ting-ting Dai, Xiong Li,* Yu-jiao Yan, Wen Xiong, Tao Lin, Jun Zhou, Deng-hui Xu,* Yao-hui Zhu, Jia Zhao, and Ai-cong Geng

Cite This: ACS Appl. Energy Mater. 2021, 4, 8175−8182 Read Online

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ABSTRACT: Active layer morphology optimization is a commonly used effective strategy to improve the photovoltaic performance of organic solar cells (OSCs). In this study, a halogen-free solvent, *o*-xylene (OX), was used as the host solvent, and dichloromethane (DCM) was used as the guest solvent to regulate the active layer morphology and enhance the power conversion efficiency (PCE) of the PM7:IT-4F nonfullerene OSCs. With the introduction of the guest solvent DCM into the host solvent OX, the crystallization of active layer is improved, and the enlarged domain size provides a favorable channel for charge transport. The improved charge transport and suppressed carrier recombination were proven by the measurement of transient photocurrent/photovoltage, photo-induced charge extraction by linear increasing voltage, and the dependence relationship of open-circuit voltage and short-circuit current density on the light illumination intensity. With the optimized volume ratio of OX and DCM, the PCE of the PM7:IT-4F OSCs improved from 10.21 to 12.74%. The binary solvent provides an effective but simple method to improve charge transport and restrict carrier recombination of the active layer, thus improving the performance of OSCs.



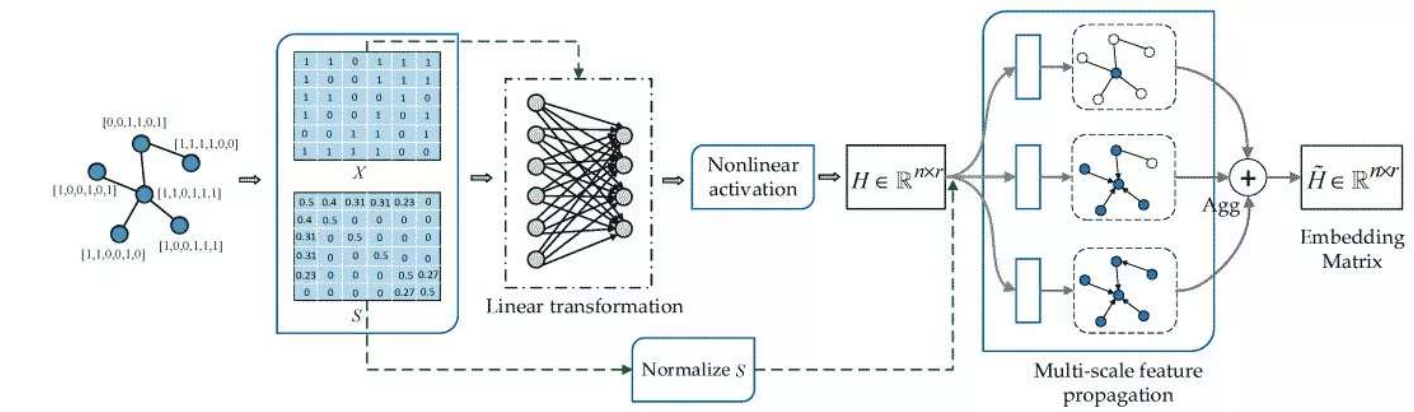
KEYWORDS: *organic solar cells, binary solvent, charge transport, recombination, power conversion efficiency*

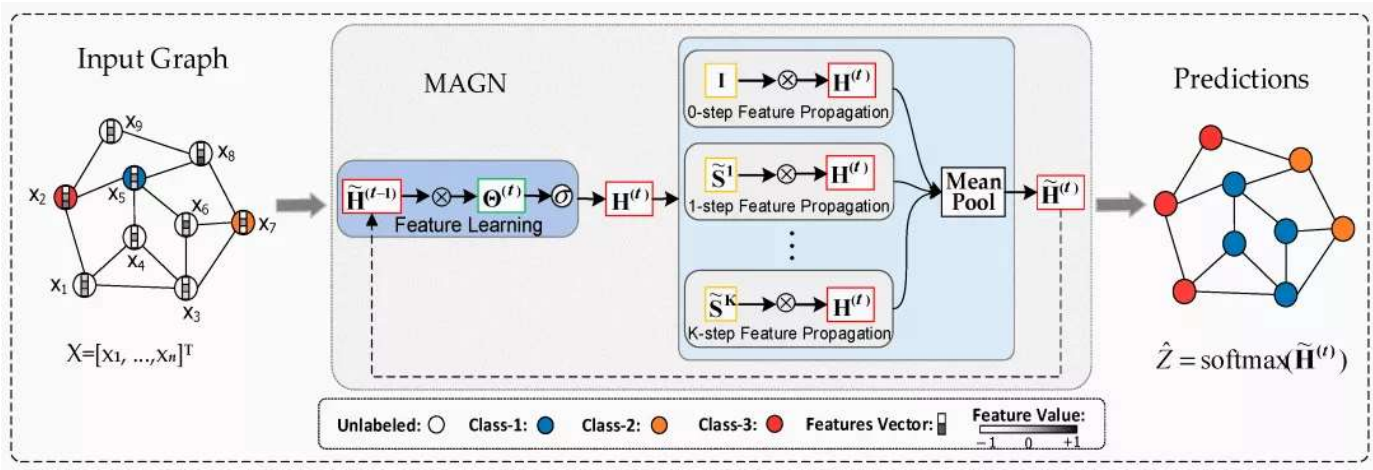
计算机学院张珣副教授发表高水平学术论文、申请发明专利

张珣副教授聚焦于多尺度图卷积网络模型研究。在《Entropy》上发表了《Multi-Scale Aggregation Graph Neural Networks Based on Feature Similarity for Semi-Supervised Learning》，并申请了《一种基于多尺度图卷积网络模型的交通预测方法》、《一种基于对称图卷积网络的文献分类方法和装置》两项发明专利。

全文链接：

https://doi.org/10.3390/e23040403.





电商与物流学院赵川副教授及团队发表高水平学术论文

赵川副教授及团队在运筹学国际期刊《Journal of the Operational Research Society》发表题为“Dynamic interactive control of inventory in a dual-channel supply chain under stochastic demand: Modelling and empirical studies”的高水平研究论文。《Journal of the Operational Research Society》是Operation Research（OR）领域最早的期刊，也是OR领域六大刊之一，声誉极佳，SCI/SSCI双检索、ABS三星。

JOURNAL OF THE OPERATIONAL RESEARCH SOCIETY
https://doi.org/10.1080/01605682.2021.1992309

ORIGINAL ARTICLE

Dynamic interactive control of inventory in a dual-channel supply chain under stochastic demand: Modelling and empirical studies

Chuan Zhao[a], Luyao Li[a], Haoxiong Yang[a] and Mingke He[b]

[a]Beijing Technology and Business University, Beijing, China; [b]Beijing Wuzi University, Beijing, China

ABSTRACT

Demand uncertainties and delivery delays are the fundamental causes of poor inventory control, especially in a dual-channel supply chain. Considering the impact of stochastic demand on the dual-channel inventory. this study explores the dynamic interactions of online–offline purchase–sale–stock systems under the decentralised, centralised, and cross-replenishment inventory controls. Hence, this study constructs a dynamic inventory model with delivery delays, based on the feedback and proportional–integral–derivative control, to optimise the influences between the replenishment cycles and online–offline channels' interactions. The results show that, when the channels follow different sales strategies and the warehouses are proximally located, the cross-replenishment inventory strategy reduces the residual inventory. When the channels follow the same sales strategies, the centralised inventory control reduces the residual inventory. These findings demonstrate that the dynamic interactive inventory model can contribute towards optimising inventory operations. This study presents substantial insights for improving the overall performances of the dual-channel supply chain from the perspectives of dynamic and interactive inventory control, warehouse and retail network optimisation, and resource allocation.

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KEYWORDS
Dual-channel supply chain; inventory optimisation; interactive control; control engineering; APIOBPCS

1. Introduction

To obtain more market share, an increasing number of enterprises, such as IBM, Nike, and Apple, have been integrating their traditional retail channels with the online channels. This provides evidence of the increasing popularity of the dynamics and system interaction of dual-channel supply chain combining the online and offline retail network. The dual-channel supply chain (Tang & Cao, 2018) comprises a direct online channel as only a factory with a distribution centre as well as a traditional offline channel as a factory with a distribution centre and several physical stores. Dual channels enable enterprises to expand their markets on the online channels. While online channels provide customers a fast and convenient platform to place orders anytime, offline channels provide a first-hand experience of goods that can be procured anytime. Concerning the other aspects associated with dual channels, the research on dual-channel supply chain mainly focuses on pricing strategy (Donya et al., 2020; Qin et al., 2020), competition and cooperation between channels (Niu et al., 2019; Wang et al., 2020), game and coordination (Tang et al., 2021; Yu et al., 2019), and dual-channel inventory control strategies (Alawneh & Zhang, 2018; Fan et al., 2019).

Unlike the single-channel supply chain, the dual-channel supply chain emphasises joint and interactive optimisation, including inventory sharing and logistics coordination. The dual-chain supply chain extends this supply chain interactivity in the replenishment cycles to that between the channels. There are several examples of dual-channel supply chain interactivity and coordination. Leading enterprises like Apple and Best Buy have been coordinating their dual-channel supply chains. Apple has opened multiple warehouses for online and offline channels in order to achieve the cross-replenishment between the two channels. While Best Buy has been operating its two-channel inventories separately, it cross replenishes the unsatisfied orders under specific circumstances. However, other enterprises, such as GAP and Uniqlo, have built a sharing inventory mode to satisfy both online and offline demands in order to reduce inventory management costs. The online–offline channels' demands are more stochastic and complex than those of the single-channel supply channel. Given this, the dual-channel inventory control strategies face challenges when facilitating dynamic interactive joint optimisation of inventory between two channels.

To facilitate the timely optimisation of the dual-channel inventory under stochastic demand with delivery delay, which includes order and transport delays, this research develops the inventory control models of dual-channel supply chain based on the

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文章指出，信息通信和网络技术的飞速发展为消费者提供多种可供选择的购物方式，也为企业多种销售渠道建设提供了可能。以李宁、苏宁为代表的企业，开创了同时具有线上和线下销售渠道的双渠道供应链，占据了更大的市场份额。针对双渠道供应链更加强调包括物流协调与库存共享在内的渠道间进销存的联合性和交互性，文章基于反馈控制、PID和延迟控制，考虑了双渠道库存周期间和渠道间的复杂动态交互性，在市场随机需求和交货延迟的背景下，分别构建了具有双输入和双输出的双渠道分散、集中和交叉补货库存控制模型，从总体最优和稳定性两个方面动态优化了企业双渠道库存策略，实现了双渠道供应链动态供需双平衡。

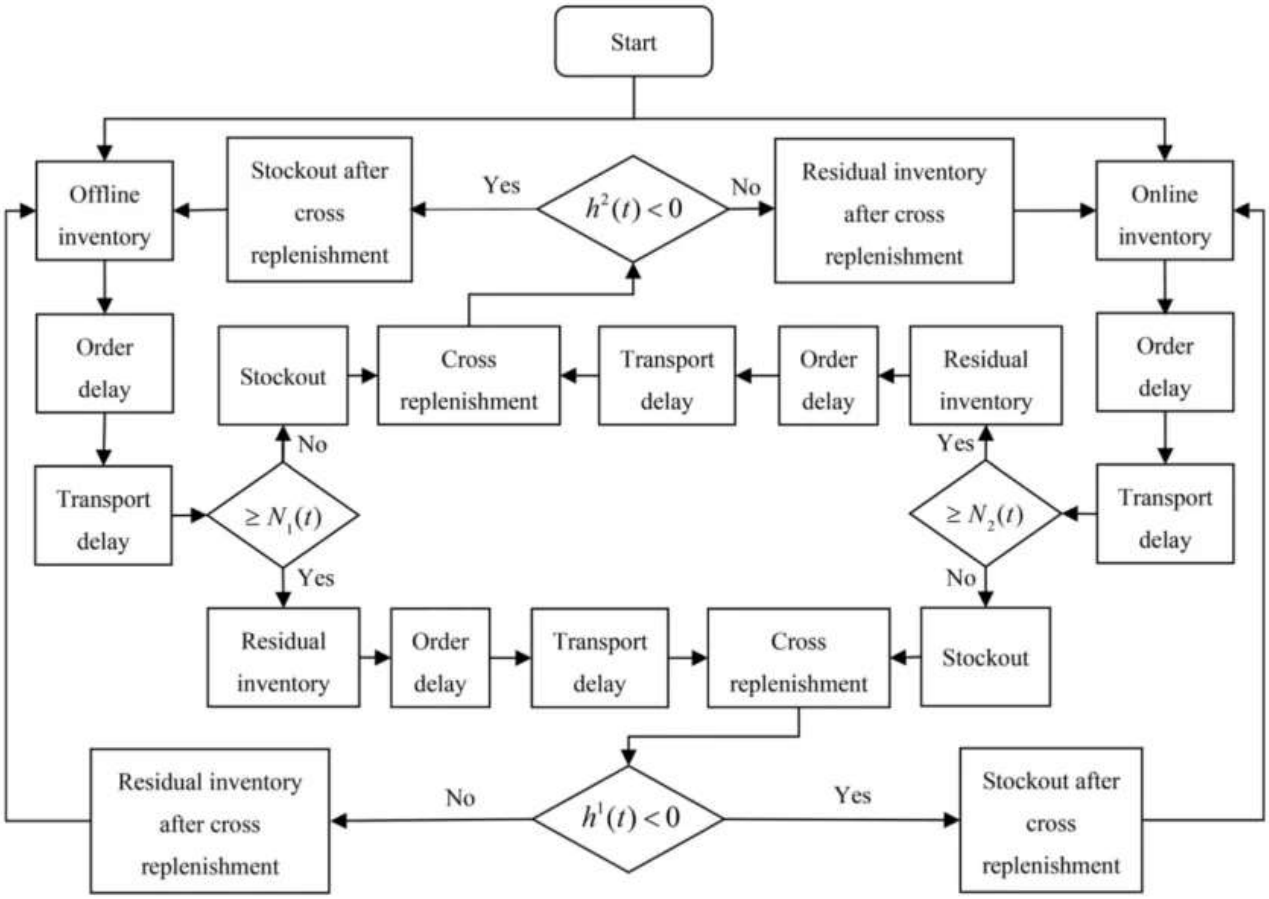


Figure 2. The flowchart of cross-replenishment inventory system.

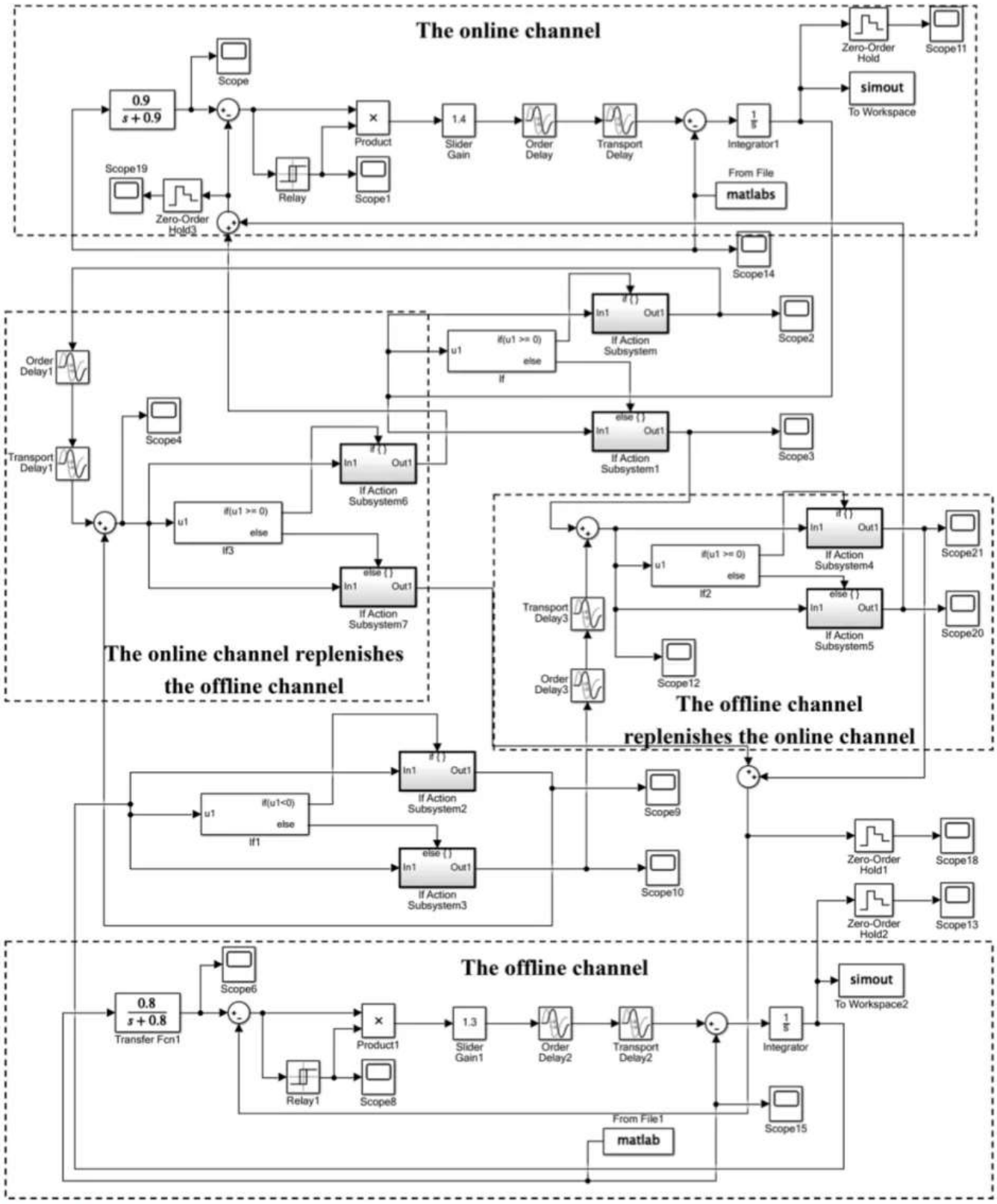


Figure 11. Emulation diagram of the cross-replenishment inventory system.

赵川副教授及团队展开大量模型推演和实证研究，结果表明，当两渠道采用不同的销售策略，且线上、线下仓库相距较近时，交叉补货策略能够有效减少库存积压和缺货现象；当两渠道采用相同的销售策略时，集中库存策略能够有效降低剩余库存。研究从动态库存控制、

资源配置和仓储与零售网络优化的角度，为企业提高双渠道供应链的整体绩效提出了可行的解决方案。

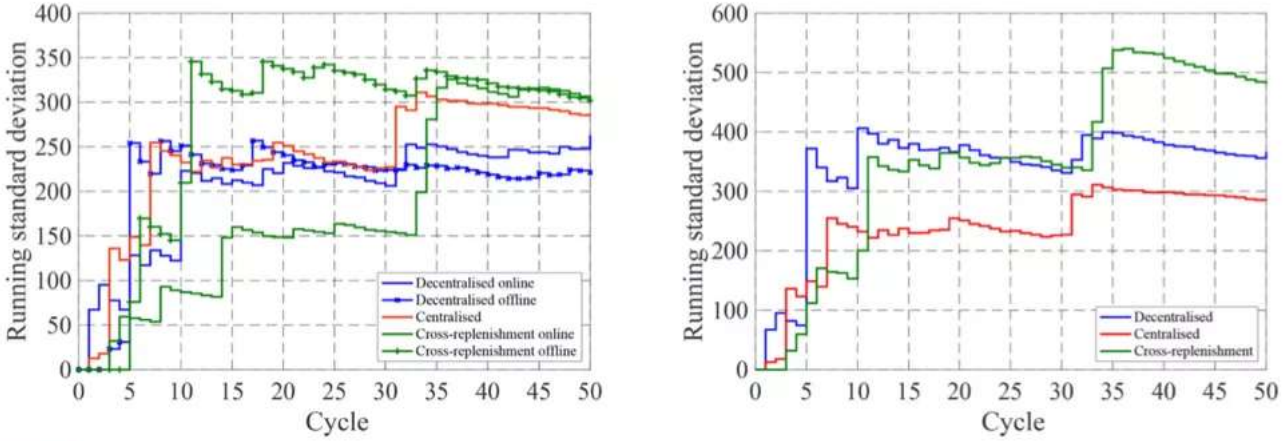


Figure 22. Running standard deviation of the residual inventory under the actual demands with a large distance between two channels' warehouses. (a) Each channel. (b) Combination of channels.

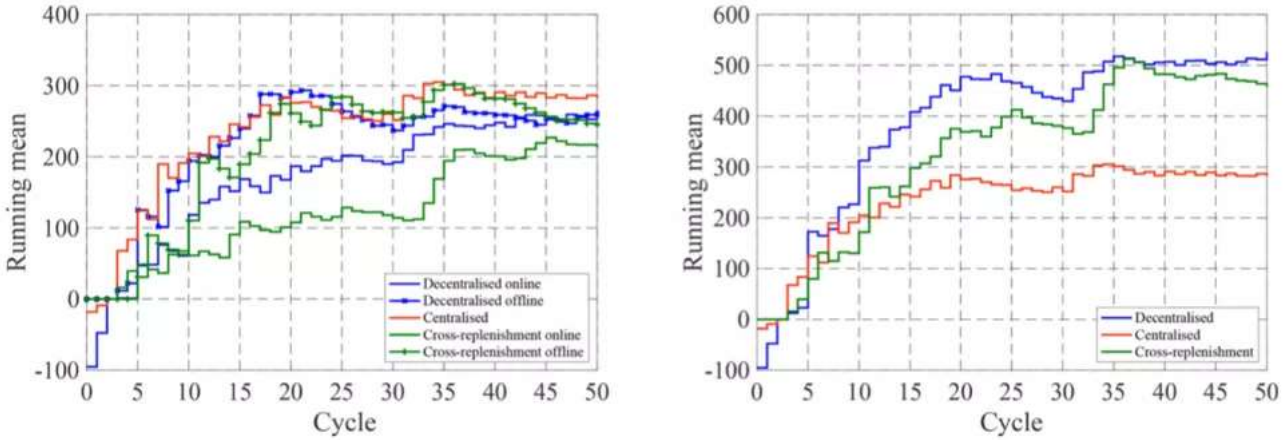


Figure 23. Running mean of the residual inventory under actual demands with a large distance between two channels warehouses. (a) Each channel. (b) Combination of channels.

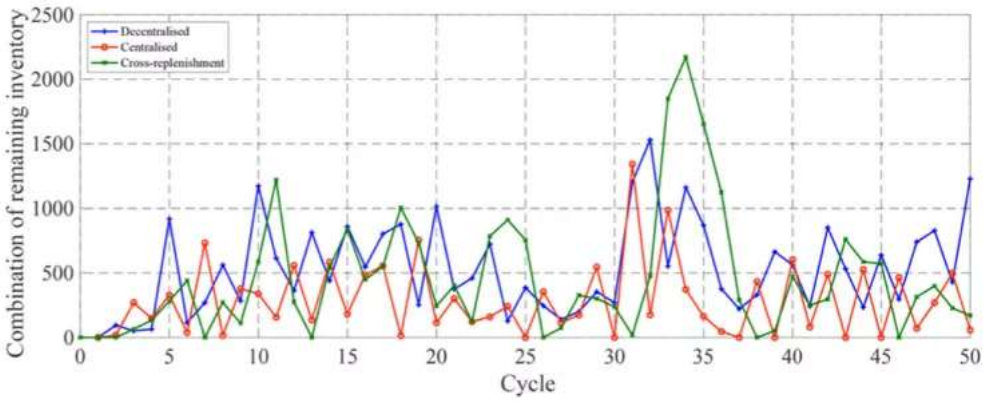


Figure 24. Combination of residual inventory under actual demands with a large distance between two channels' warehouses.

Table 10. Inventory strategies under different scenarios.

Scenario		
Sales strategy	Distance between the retailer and the supplier	Strategy
Different	Greater	Cross-replenishment inventory strategy
	Smaller	Centralised inventory strategy
Same	Greater	Centralised inventory strategy
	Smaller	Centralised inventory strategy

法学院王迎龙副教授发表高水平学术论文

王迎龙副教授长期致力于刑事诉讼法学与律师制度领域的研究。此次对于刑事诉讼法律规范的发展趋势的研究论文《论刑事诉讼规范的刑事政策化》，发表在国内法学重量级核心期刊《法学家》。

法学家 The Jurist No.6, 2021

论刑事诉讼规范的刑事政策化

王迎龙

摘 要 现代刑事诉讼以程序多元化的发展为具象与表征，具备不断满足与回应社会现实需求的功能与品性。刑事诉讼规范的刑事政策化，是从社会视角对刑事诉讼规范发展趋势的一种理论概括。刑事政策作为社会需求的系统表达，在社会与法律之间充当媒介，将目的理性灌输到刑事诉讼规范体系的构建与适用。刑事政策对我国刑事诉讼规范体系的影响，历经了政治主导、政策与法律分立与刑事政策化三个发展阶段，逐渐从外部的实体性影响发展成为内部的目的性与价值性指引，使得规范体系的构建愈发具有功能主义特性。刑事诉讼规范的刑事政策化，意味着政治力量不再非理性地加诸法律之上，而是以刑事政策为载体，成为刑事诉讼规范逻辑演绎的内在结构参数，这体现在刑事政策的立法化与对法律解释的合目的性指引两个层面。然而，刑事政策的功利性导向与目的性思维，仍易对个体自由构成危害。因此，政治力量应当受到法律系统的有效规训。有必要建构一种刑事诉讼教义内部规范与合宪性外部控制的二元规训机制，确保政治力量遵循法律逻辑施加影响。

关键词 刑事政策 诉讼程序多元化 功能主义 法教义学

作者王迎龙，法学博士，北京工商大学法学院副教授。

来源丨科学研究院

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