생명환경화학과 소식지

Department of Life Science & Environmental Biochemistry

■ 학과 소식 ■

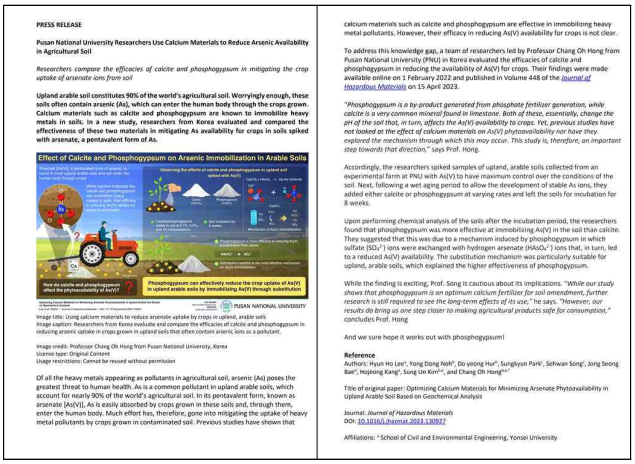
[교수동정]

- 홍창오 교수: 한빛사(한국을 빛낸 사람들) 등록
- 이광민 교수: 한양대학교_분자생명과학과 학과세미나 강연(Exploring the role of Cereblon, a novel AMPK regulator)(2023.04.11.)
- 이광민 교수: 생화학분자생물학회 참석 및 포스터 발표(2023.05.11.~05.12.)
- 김유진 교수: 2023년 국립식량과학원 남부작물부_생산기술개발과 현장명예연구관 간담회 참석(2023.03.30.)
- 김유진 교수: 부산대학교 윤인구 신진연구자상 수상

■ 연구 소식 ■

[논문게재 및 저서발간]

- 홍창오 교수:
  2022학년도 우수연구성과 글로벌 홍보 사업 선정
  - 게재지명: Journal of Hazardous Materials (SCIE) IF: 14.224 Environmental Science 분야 JCR 상위 3.23%
  - 홍보 타이틀: Pusan National University Researchers Use Calcium Materials to Reduce Arsenic Availability in Agricultural Soil



PRESS RELEASE

Pusan National University Researchers Use Calcium Materials to Reduce Arsenic Availability in Agricultural Soil

Researchers compare the efficacies of calcite and phosphogypsum in mitigating the crop uptake of arsenate ions from soil

Upland arable soil constitutes 90% of the world's agricultural soil. Worryingly enough, these soils often contain arsenic (As), which can enter the human body through the crops grown. Calcium materials such as calcite and phosphogypsum are known to immobilize heavy metals in soils. In a new study, researchers from Korea evaluated and compared the effectiveness of these two materials in mitigating As availability for crops in soils spiked with arsenate, a pentavalent form of As.

Effect of Calcite and Phosphogypsum on Arsenic Immobilization in Arable Soils

How do calcite and phosphogypsum affect the phytoavailability of As(V)?

Phosphogypsum can effectively reduce the crop uptake of As(V) in upland arable soils by immobilizing As(V) through substitution

PUSAN NATIONAL UNIVERSITY

Image title: Using calcium materials to reduce arsenate uptake by crops in upland, arable soils

Image caption: Researchers from Korea evaluate and compare the efficacies of calcite and phosphogypsum in reducing arsenic uptake in crops grown in upland soils that often contain arsenic ions as a pollutant.

Image credit: Professor Chang Oh Hong from Pusan National University, Korea

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Of all the heavy metals appearing as pollutants in agricultural soil, arsenic (As) poses the greatest threat to human health. As is a common pollutant in upland arable soils, which account for nearly 90% of the world's agricultural soil. In its pentavalent form, known as arsenate [As(V)], As is easily absorbed by crops grown in these soils and, through them, enter the human body. Much effort has, therefore, gone into mitigating the uptake of heavy metal pollutants by crops grown in contaminated soil. Previous studies have shown that calcium materials such as calcite and phosphogypsum are effective in immobilizing heavy metal pollutants. However, their efficacy in reducing As(V) availability for crops is not clear.

To address this knowledge gap, a team of researchers led by Professor Chang Oh Hong from Pusan National University (PNU) in Korea evaluated the efficacies of calcite and phosphogypsum in reducing the availability of As(V) for crops. Their findings were made available online on 1 February 2022 and published in Volume 448 of the *Journal of Hazardous Materials* on 15 April 2023.

"Phosphogypsum is a by-product generated from phosphate fertilizer generation, while calcite is a very common mineral found in limestone. Both of these, essentially, change the pH of the soil that, in turn, affects the As(V) availability to crops. Yet, previous studies have not looked at the effect of calcium materials on As(V) phytoavailability nor have they explored the mechanism through which this may occur. This study is, therefore, an important step towards that direction," says Prof. Hong.

Accordingly, the researchers spiked samples of upland, arable soils collected from an experimental farm at PNU with As(V) to have maximum control over the conditions of the soil. Next, following a wet aging period to allow the development of stable As ions, they added either calcite or phosphogypsum at varying rates and left the soils for incubation for 8 weeks.

Upon performing chemical analysis of the soils after the incubation period, the researchers found that phosphogypsum was more effective at immobilizing As(V) in the soil than calcite. They suggested that this was due to a mechanism induced by phosphogypsum in which sulfate (SO_4^{2-}) ions were exchanged with hydrogen arsenate ($HAsO_4^{2-}$) ions that, in turn, led to a reduced As(V) availability. The substitution mechanism was particularly suitable for upland, arable soils, which explained the higher effectiveness of phosphogypsum.

While the finding is exciting, Prof. Song is cautious about its implications. *"While our study shows that phosphogypsum is an optimum calcium fertilizer for soil amendment, further research is still required to see the long-term effects of its use,"* he says. *"However, our results do bring us one step closer to making agricultural products safe for consumption,"* concludes Prof. Hong

And we sure hope it works out with phosphogypsum!

Reference

Authors: Hyun Ho Lee[1], Yong Dong Noh[2], Do yeong Hur[2], Sungkyun Park[1], Sehwan Song[1], Jong Seong Bae[2], Hojeong Kang[2], Sung Un Kim[2,3], and Chang Oh Hong[1,2,*]

Title of original paper: Optimizing Calcium Materials for Minimizing Arsenate Phytoavailability in Upland Arable Soil Based on Geochemical Analysis

Journal: *Journal of Hazardous Materials*

DOI: 10.1016/j.jhazmat.2023.130927

Affiliations: [1] School of Civil and Environmental Engineering, Yonsei University

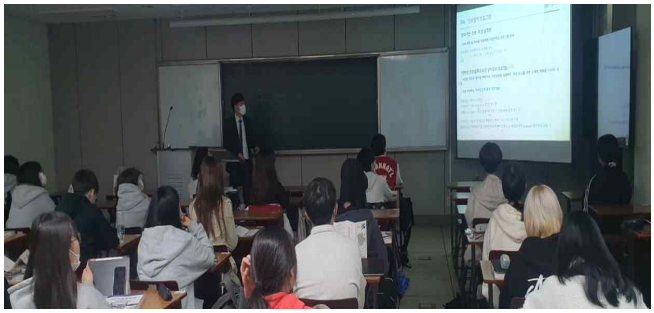
- 이광민 교수: 인간 피부각질세포에서 Hydrogen peroxide로 유도된 산화적 스트레스에 대한 붉은토끼풀 추출물의 세포 보호 효과(한국응용과학기술학회지, 교신저자)
- 김유진 교수: Protocol for efficient ginseng transformation (Plant Cell Tiss Organ Cult 교신저자)
- 김유진 교수: Proteomic Analysis Reveals a Critical Role of the Glycosyl Hydrolase 17 Protein in Panax ginseng Leaves under Salt Stress. (Int. J. Mol. Sci. 교신저자)

[연구비수주]

- 과제명: 토지이용 변화에 따른 토양탄소 흡수량 측정 방법론 및 산정 고도화 연구
  - 지원기관: 국립농업과학원
  - 연구책임자: 홍창오
  - 연구기간: 2023.04.01.~2027.12.31.
  - 수주금액: 8억 5천만원
- 과제명: 작물 반수체 유도·기작규명 기초연구실
  - 지원기간: 한국연구재단
  - 연구책임자: 김유진
  - 연구기간: 2023.06.01.~2026.02.28.

[세미나 및 행사]

- 2023학년도 1학기 Outreach프로그램(찾아가는 진로·취업 설명회) 실시
  - 일시: 2023. 04. 25(화) 14:30~
  - 대상: 1학년 신입생



• 2023학년도 1학기 마인드핏 실시
- 일시: 2023. 06. 02(금) 11:30~
- 대상: 1학년 신입생

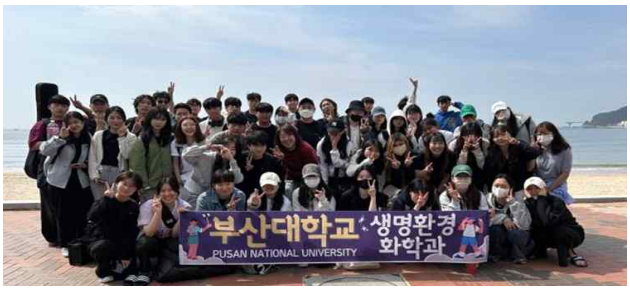
[수상 및 장학]

• 2023년도 부산대학교 안전관리 우수연구실 선정
- 연구실명: 식물분자생물학실험실
- 연구실 책임자: 김유진 교수

• (재)3·1문화재단 장학생 선정
- 수상자: 박사과정 박규림(지도교수 손홍주)

[학생 활동]

• 2023학년도 1학기 재학생 대학생활 적응력 향상을 위한 집단연수 실시
- 2023년 5월 11일(목)~12(금)(1박2일)
- 부산 송정 일대



• 2023학년도 1학기 재학생 체력증진 단합대회
- 2023년 5월 24일(수)
- 교내 운동장