Partitioning of Arsenic (V) on Biomembrane

Le Quoc TUAN[1], Tran Thi Thanh HUONG[2], Pham Thi Anh HONG[3], Tomonori KAWAKAMI[4], Hiroshi UMAKOSHI[1], Toshinori SHIMANOUCHI[1], Ryoichi KUBOI[1]*

[1]Graduate School of Engineering Science, Osaka University, 1-3 Machikaneyama, Toyonaka 560-8531, JAPAN
[2]Faculty of Basic Science, Nong Lam University, Ho Chi Minh City, VIETNAM、, [3]University of Natural Sciences, Vietnam National University of Ho Chi Minh City, VIETNAM
[4]Toyama Prefectural University, 5180 Kurokawa, Imizu City, Toyama, 939-0398 JAPAN * msb@cheng.es.osaka-u.ac.jp

Overview

Arsenic (**As**) is one of the most significant toxicants dispersed in the global environment. Humans can be exposed to **As** through the intake of air, food, and water.

Some roles of **biomembrane** in **As** removal were specified but their mechanisms have been a little found out.

The present research is aiming to determine the **As partitioning on biomembrane** when arsenic interacts with membranes.

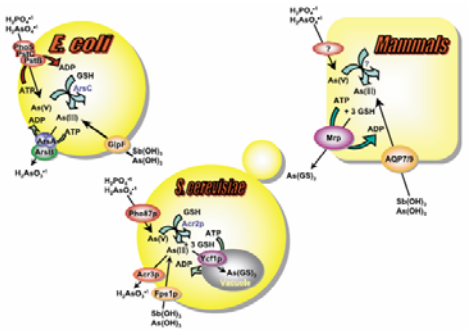


Fig.1 As Uptaken into Cell

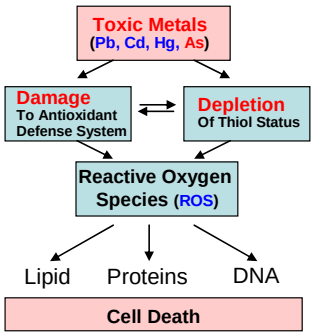


Fig.2 Toxicity of As

1. As Partitioning on Biomembrane and Its Response

Typical Toxicity of As

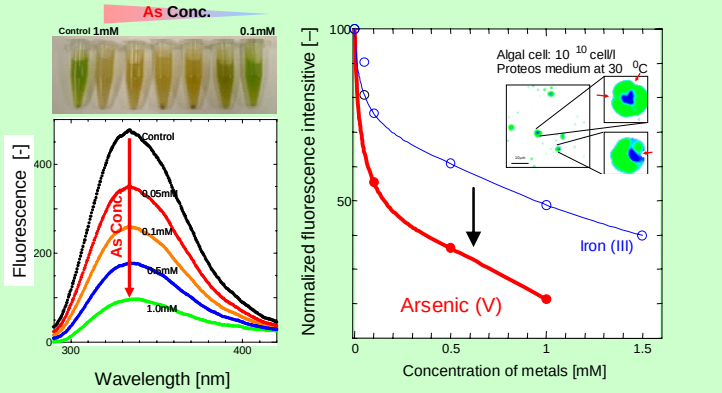


Fig. 3 Variation of cell viability as a function of concentration of arsenic (V) and Fe (III)

Toxic Metals Induce Cell death, depending on Toxicant Concentration

Relation with As Partitioning

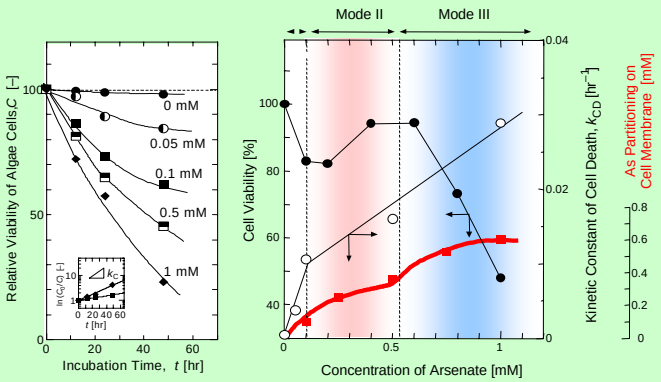


Fig. 4. Viability of algal cells in presence of arsenic (V) ions and arsenic adsorption on cell membrane.

1st Step: Slight Decrease of Viability (can be Repaired)
2nd Step: Significant Reduction in Viability (>0.5mM)

2. As Partitioning on Model Biomembrane and Its Response

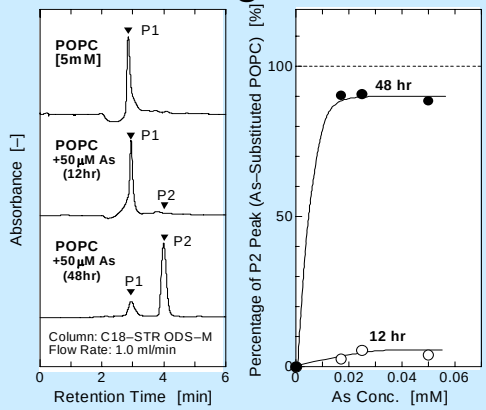
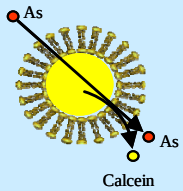


Fig. 5 RP-HPLC analysis of arsenic substituted POPC. Incubation of POPC 5 mM with As 50 μM in 30^{0}C in phosphate buffer pH 7.4.



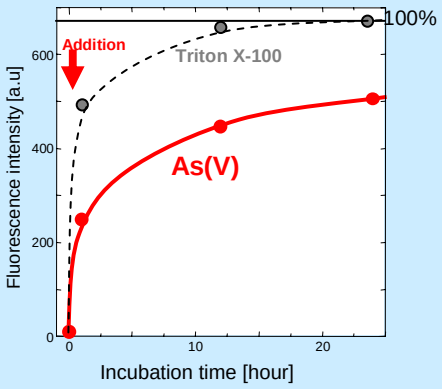


Fig. 6 Model membrane (Liposome) experiment: The release of calcein in different incubation time; 5 mM POPC/50 μM As (100/1 molar)

Strong interaction between As and model biomembrane results in the substitution of phosphate head by arsenic.

Membrane fluidity was Extremely Enhanced under Toxic Stress. Membrane Structure was Activated by As.

Conclusion

- High affinity of As for phospholipid molecule and liposome membrane results in As partitioning on biomembrane.
- Bio-membrane can recruit As with high efficiency in three phases: (1) binding, (2) partitioning and (3) substitution.
- Bio-membrane can be useful for removing toxicants from environment.

Reference

J. Chemophere **60**, 1550-1554 (2005).
J. Med. Chem. **43**, 4617-4628 (2000).

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•リポソーム基礎工学研究会