

## **Biological filtration applied in Hanoi, Vietnam to remove arsenic from well water at very low cost**

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## **Sand filtration pond in Viet Nam**

**Iron bacteria** : A name for various bacterial species that biologically oxidize dissolved Fe and/or Mn, and deposit Fe and Mn oxides.

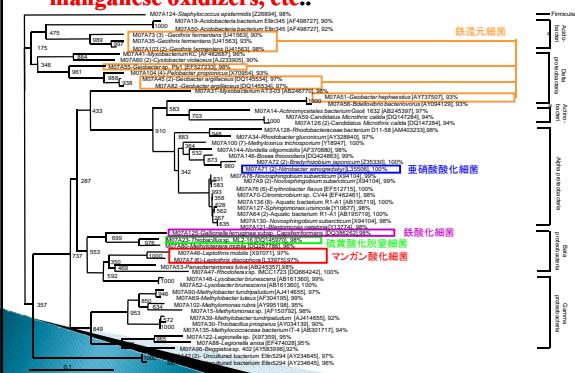
## **Iron and iron bacteria**

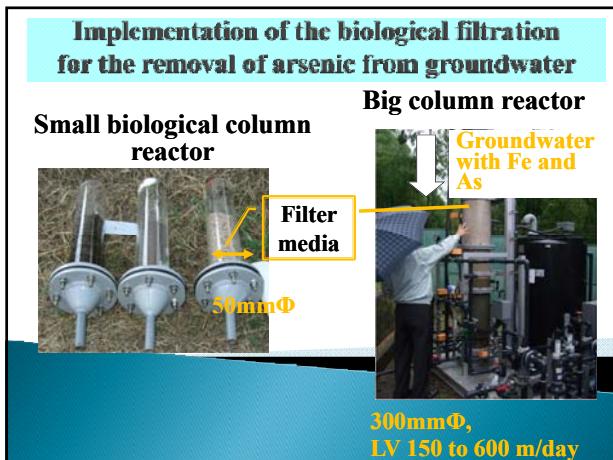
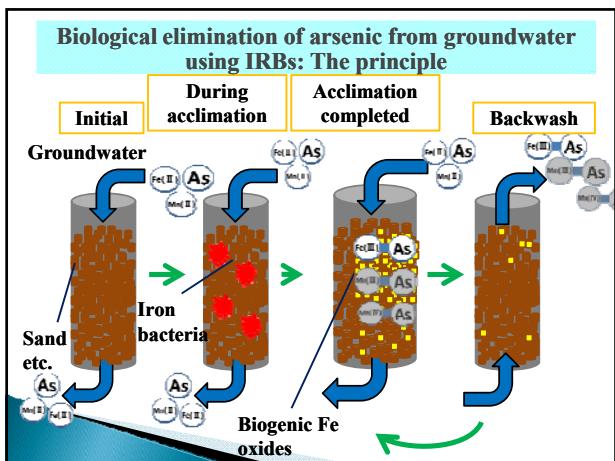


## **Iron bacteria (IRB) – gelatinous slime in natural water containing iron – Annoyance ?**

**Leptothrix discophora,  
pure culture ( $\times 1000$ ).  
One of the IRBs**

**Indigenous groundwater microbes on the filter:  
iron oxidizing and reducing bacteria, nitrifier,  
manganese oxidizers, etc..**

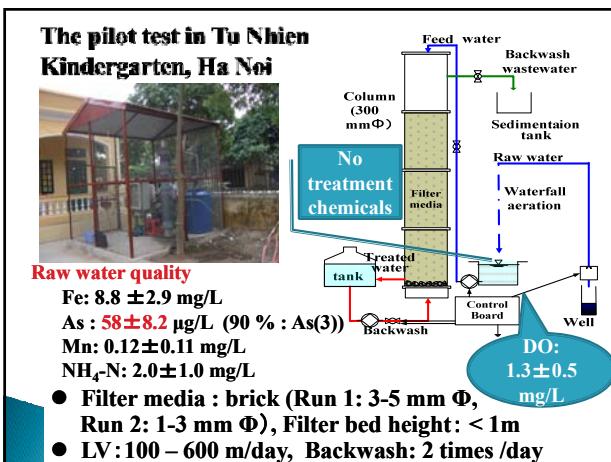
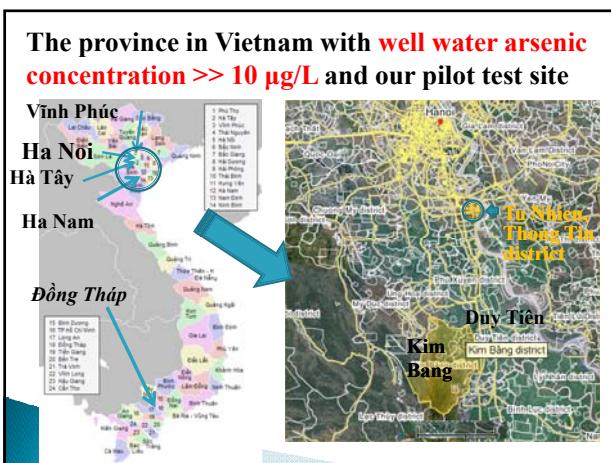
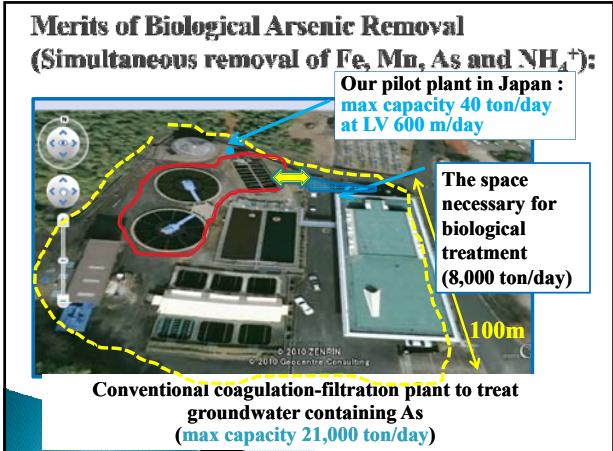




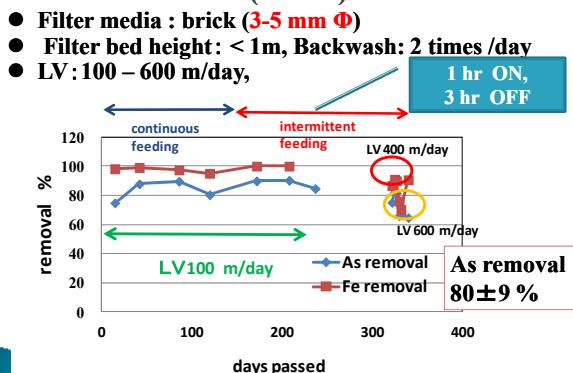
**Preceding work -7 yr pilot study in Japan**

**removal**      **operation**

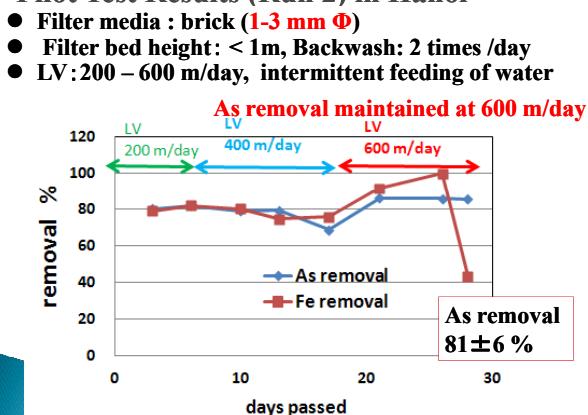
Run	Fe	As	m/d	Aeration	Filter	Filter height	Feed water storage (days)
1	45%	0%	5d	150	×	Plastic	
2	76%	72%	0d	150	×	Plastic	
3	96%	71%	0d	150	O		
4	86%	89%	0d	300	O		
5	98%	76%	0d	600	O	1.5m	
6	97%	50%	0d	150	O	Plastic +zeolite	
7	95%	74%	0d	150	O	sand	
8	97%	71%	0d	600	O	sand	
9	98%	66%	0d	600	O	sand	1.0m



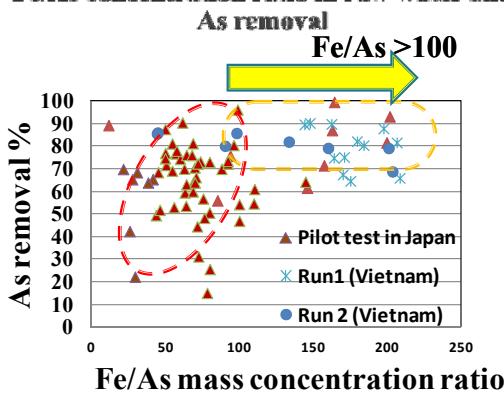
### Pilot Test Results (Run 1) in Hanoi



### Pilot Test Results (Run 2) in Hanoi



### Fe/As concentration ratio in raw water and As removal



## Conclusions

- ▶ Raw water containing  $8.8 \pm 2.9$  mg/L of Fe and  $58 \pm 8.2$  µg/L of As (90 % was As(3)) could be successfully treated by the biological filtration in Hanoi, VN, despite the shortage of electricity and intermittent mode of operation.
- ▶ The pilot system was fairly simple, could be easily maintained by Vietnamese engineers, and was operable without treatment chemicals.
- ▶ **Fe/As mass concentration ratio >100** lead to the stable removal of As in VN

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