EMERGING WATER ENVIRONMENT ISSUES IN ASIA

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Asia and the Pacific at a Glance

- Total land area - 23% of the world’s total land area
- Great variation in geography, topography and climate
- Diverse environmental conditions
- Increase in environmental degradation with the increase of population, industrialization and development activities
- Most populous region of the world - 58% of the world’s population reside in the region
Urbanization and Industrialization

Urbanization level (%)  
Asia and the Pacific

- 0-20%
- >20-40%
- >40-60%
- >60-80%
- >80%
- missing data

Urbanization and Industrialization:

- Slum: human tragedy, Mumbai, India
- White light attraction, Singapore
- Industrialization & shadowed environment, Steel Industry
- Petroleum Industry
Discharge of untreated or partially treated wastewaters pollute nearby water bodies, eliminating downstream use.
Water pollution problems

- Anaerobic condition
- Polluted canals
- Health impact of arsenic
- Fish death
Fresh Water Withdrawals in the GMS

- Internal renewable water resources per capita (cubic meters per year, 2000)
- Annual fresh water withdrawal per capita (cubic meters, 1987-97)
The water level in Kulekhani reservoir sharply declined in dry season. The water level in the reservoir is decreasing by as much as 30 centimeters a day. An NEA official warned that the reservoir will run dry in three weeks.
Emerging Environmental Issues

- Micro-pollutants
  - Pharmaceuticals and Personal Care Products (PPCPs)
  - PFOS/PFOA
Distribution of PPCP in Aquatic environment

**Large quantities** of PPCP can enter water bodies
E.g. *Flush*ing unused medications down the toilet,
*Rins*ing soap, shampoo and cosmetic down the drain

Drug residues discharged into SW → **Antibiotics and Hormone steroids** have been identified in water sample

**Human health effect** and aquatic organism  
(Higher risk at low dosage)  
→ Resistance to antibiotic  
→ Disruption of endocrine system  
→ Carcinogen
Occurrence of PPCP in water aquatic

- **In Italy**, amount of PPCPs (antibiotic, antiflamatory, cardiovascular etc.) discharged to SF water in amount ranging between 60-180 Kg/d
- **In USA**, Naproxen was detected in *Louisiana and Ontario surface water* at 22-107 ng/l and Tricosan detected at 10-21 Ng/l of sewage treatment plant effluent.
- **In China**, the distribution of clobric acid (lipid regulation drug), caffeine, and DDEET (*N,N*-diethyl-3-toluamide or insect repellent) at 19, 16 and 1.1 ng/l

**Conventional treatment** system can not take out PPCP completely

Promising technology include.....
- Oxidation
- Ozonation
- Activated Carbon
- Reverse Osmosis
PFOS / PFOA: New POPs of Concerns

What are PFOS and PFOA?

**Fully Fluorinated Organic Compounds (FOCs)**

**PFOS:** Perfluoro-octane Sulfonate \( \text{C}_8\text{F}_{17}\text{SO}_3^\text{-} \)

**PFOA:** Perfluoro-octane Acid \( \text{C}_8\text{F}_{15}\text{OO}^- \)

Where are they from?

**PFOS:** surface treatment, paper protection, performance chemical

- e.g. Carpet; Cup & plate; Fire fighting foam; Semi-conductor; Scotchgard

**PFOA:** Emulsifier and surfactant

- e.g.; Soap; Shampoo; Teflon; Gore-tex
Data from U.S.A. – Surface Water and Industrial Wastewater

New York State
- PFOA - 10-173 ng/L
- PFOS – 0.8- 30 ng/L
- Lake Onondaga has PFOS 198-1,090 ng/L

California State
- Wastewater from semi-conductor industry, PFOS – 1,650 mg/L
Bioconcentration Factor (BCF) = concentration in fish/concentration in water

- **PFOS**
  - Japan, Lake Biwa – 46,000
  - Japan, Tokyo Bay – 6,600
  - U.S.A, New York – 8,850

- **PFOA**
  - U.S.A., New York - 184
Potential Technology

- Nanotechnology: application to degrade/monitor environmental pollutants and etc.
  - ZnO nanoparticles for degradation of pesticides and POPs
  - Onsite application of gas monitoring system using nanoparticles/nanosensors
P Recovery Through Struvite Crystals

- Synthetic wastewater
- Urine
- Piggery wastewater
- Struvite by SEM
Role of Higher Education Institute
The Mission of AIT

In the Context of the Emerging Environment is

“To develop highly qualified and committed professionals who will play a leading role in the sustainable development of the region and its integration into the global economy”