2012.03.14-Tokyo



Water Pollution Control -Challenges and Efforts in China-

Min Yang

State Key Lab. Of Aquatic Environmental Chemistry Research Center for Eco-Environmental Sciences Chinese Academy of Sciences



Water situation in China

River Water Quality



Only 30% sections were suitable for drinking.

Efforts for STP Construction

For 665 cities



1993 treatment plants with a total capacity of 100 mil m³/d

Each city has 3 STPs in average.

More Plants in Construction



The capacity will be increased to 160 mil m³/d in the cities.

Changes of Capacity in Beijing



Distribution of STP in Beijing



Main Processes in Beijing



Gao Bei Dian STP



Jiu Xian Qiao STP

Capacity : 0.2 mil ton/d Oxidation Ditch

Qing He STP

Capacity : 0.4 mil ton/d
To be increased to 0.55 mil m³/d
A2O

Bei Xiao He STP

Capacity : 0.1 mil ton/d MBR

Effects of Investment



The percentage of high quality river sections is increasing with the increase of treatment percentage.



Challenges

Problems for Sewage Treatment

•Among 665 cities, over 100 cities do not have sewage treatment facilities in operation. **•65%** county towns do not have any sewage treatment facilities. •Many facilities are in poor conditions. •No clear roadmap for sludge disposal technologies.

Challenges for Villages & Towns

- Town number: 34369 (0.16 b)
- Village number: 0.57 million (0.76 b)
- Population in T&V area: 930 million (71.8%).
- Lack of facilities.
 - <5% of small towns have sewage treatment facility;
 - <4% of villages have drainage systems, and sewage

treatment ratio is less than 1%.

Pollution Loads from Villages & Towns

	Town	Village	T&V	Urban
SV(10 ⁸ m ³ /a)	3.6	5.6	9.2	33.0
COD (10⁶ t/a)	2.6	5.4	8.0	8.6
N(10 ⁶ t/a)	0.5	1.1	1.6	0.97
P(10 ⁶ t/a)	0.04	0.07	0.11	

SV: sewage volume

The pollution loads from T&V are in equivalent to urban areas.

Water Resource Distribution

North : South Water resource: 16% : 84% cultivated land : 69% : 31%

Precipitation in north, 50-800mm



North China: highly populated and dry region Northeast China North 🖂 Northwest China China East China Southwest Middle China China 台湾 South 澳门 China

Serious water deficiency in North China.

Other Challenges

- Defuse pollution in rural and urban areas.
- Soil & groundwater pollution
- Intensive industrial discharges
- Poor management of water environment
- Emergent pollutants and their ecological

and health impacts

Efforts to cope with the challenges

Pollutant cut targets

10% cut for COD during 2006-2010



10% cut for COD and NH₃ during

2011-2015

Major Program of Science and Technology for Water Pollution Control

•Budget (2008-2020) : 30 bil RMB

•Over 300 research subjects

•Over 5000 researchers

•Regions : in 22 provinces.

- 1. Lake
- 2. River
- 3. Urban drainage systems
- 4. Drinking water systems
- 5. Water basin systems
- 6. Water environmental management & policy men

mental Sciences

http//www.rcees.ac.cn

Water Reuse in Beijing



Reclaimed water will be an important water resource for Beijing.

Existing Capacity in Beijing

25×10^4 m³/d in total.

http//www.rcees.ac.cn

Plant	Process	Capacity		
Gao Bei Dian	C/S+SF	$1 \times 10^4 \mathrm{m^{3/d}}$		
Qing He	UF+O ₃	$8 \times 10^4 \mathrm{m^{3/d}}$		
Bei Xiao He	MBR+ O ₃	$6 \times 10^4 \mathrm{m^{3/d}}$		
Wu Jia Cun	$C/S+SF + O_3+UV$	$4 \times 10^4 \mathrm{m^{3/d}}$		
Jiu Xian Qiao	$C/S+SF + O_3+UV$	$6 \times 10^4 \mathrm{m^{3/d}}$		

•Conventional treatment is adopted for particle removal.

•O₃ is adopted for the removal of color and T/O.

•Reclaimed water is used for industrial, municipal and scenic purposes.

Capacity in Tianjin

19×10^4 m³/d in total.

Research Center for Eco-Environmental Sciences http//www.rcees.ac.cn

Plant	Process	Capacity
Ji Zhuang Zi	C/S+MF	$2 \times 10^4 \mathrm{m^{3/d}}$
	$SMF+(partial) RO+O_3$	$5 \times 10^4 { m m^{3/d}}$
Bei Chen	C/S+SMF	$1.5 \times 10^4 \mathrm{m^{3/d}}$
	UF +(partial) $RO + O_3$	$0.5 \times 10^4 \mathrm{m^{3/d}}$
Dong Jiao	$SMF+(partial) RO+O_3$	$5 \times 10^4 \mathrm{m^{3/d}}$
Xian Yang Lu	C/S +SMF + (partial) RO +O ₃	$5 \times 10^4 \mathrm{m^{3/d}}$

•Membrane is used extensively.

•RO is adopted for reducing salinity.

Comparison between Beijing and Tianjin

Reuse volume in urban area

	Beijing		Tianjin			
	2007	2008	2009	2007	2008	2009
Volume/10 ⁴ m ³	48000	62000	64999	329	352	372
Reuse percentage/%	33.6	43.4	45.0	2.5	2.7	2.9

Reuse structure, %

	Industry	Scenic	Municipal	Total
Beijing	45	48	7	100
Tianjin	20	15	65	100

黎松强,涂常青.水污染控制与资源化工程[M],武汉理工大学出版社,2009,15 陈桂琴,吴斌,天津市再生水回用现状与发展[J],供水技术,2010(42),61~64



Wastewater Reclamation Plants







Wastewater reclamation plants are usually built beside the sewage treatment plants, and operated independently.

Reclaimed Water for Scenic Purposes



•Water supplementation to urban rivers and lakes.



Reclaimed Water for Industries





Reclaimed water for a chemical plant

Reclaimed water for a neighboring power plant from Gao Bei Dian Plant.

Industries are one of the main customers of reclaimed water.
Major users include power plants, heating plants and chemical plants.

Reclaimed Water for Municipal Purposes







•Although the distribution cost is relatively high, reclaimed water is extensively used for municipal purposes to show the determination of governments.

Suggested Cooperation Topics



- Water basin management strategies
- Discharging and water environment standards
- Improving performance and energy efficiency of STPs
- Control of toxicity discharge from industrial activities
- Adaptation of urban drainage systems to climate changes
- Sewage treatment systems for rural regions
 - Water reuse



Drinking water safety



- Source water management
- Facility management and energy efficiency
- Water loss reduction
- Emergent pollutants and risk assessment



Work in My Groups



Research interests of our group



Sludge bulking control

Optimization of sewage treatment systems

Risk control for water reuse



Research interests of our group





Research interests of our group







