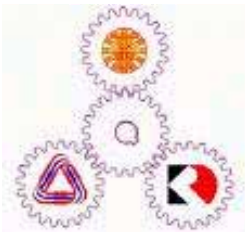


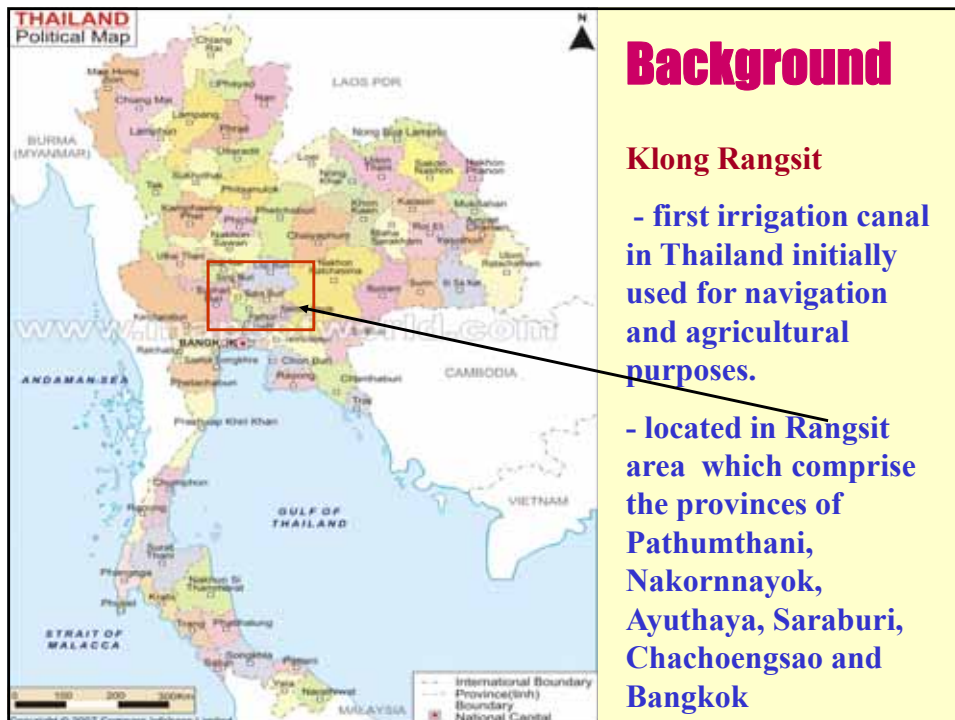
Low Cost Community Based Treatment Unit for Food Vendors and Slum Community in Thailand

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Industrialization and agricultural activities have created many new settlements around the Klong

Floating food vendors selling noodles on floating boats are now a common sight in Bangkok



Slum dwellers around the Klong is also a common sight

Rationale of the Study

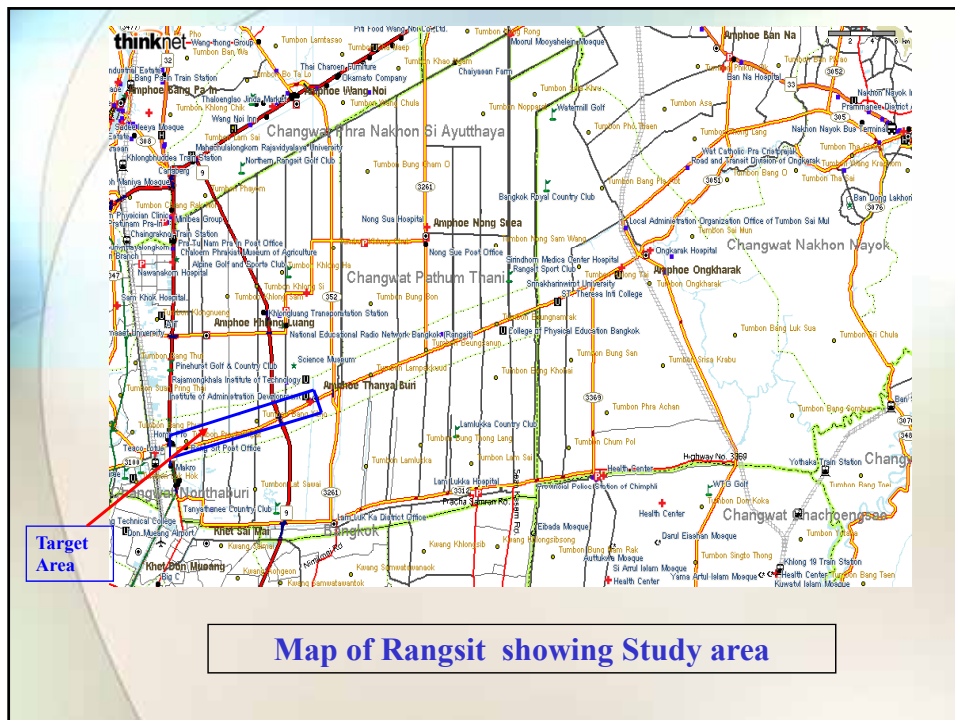
- **Settlements around the Klong including the food vendors and the slum community discharge untreated wastewater causing deterioration of water quality of the Klong water.**
- **Since the Klong water is also used by the food vendors and slum community for domestic purposes, contaminated water can cause waterborne diseases**
- **The Local government also plan to use the Klong for recreation and tourism purposes**
- **Hence, the need for a more sustainable way of protecting the degradation of the Klong water ecosystem.**

Objectives of the Study

- **To protect the ecosystem of Klong Rangsit by creating environmental awareness and introducing low-cost wastewater treatment system for the floating food vendors and the slum community**

Methodology

- ❑ **Survey of Study Area** – area selected consists of 5 sub-canal of Klong Rangsit 1-5. Survey was done to determine background information on water use, wastewater discharge, health condition and sanitation
- ❑ **Water and Wastewater Analysis** – water samples were collected at selected areas along Rangsit 1-5, waste water samples were collected from 11 floating food vendors. Analysis was done using Standard Methods. Parameters Analyzed: pH, BOD, DO,TKN,TS, TSS, TDS, oil and grease, turbidity and color (only for water), total coliform and faecal coliform



Methodology

- ❑ **Design of Low-Cost wastewater Treatment System – for floating food vendors and slum community, based on wastewater characteristics from food vendors.**
 - Treatment system employs both physical and biological processes
 - Consist of oil skimmer (commercially available - 30 L capacity) and treatment bucket (fabricated - 60 L capacity)
 - Treatment bucket where physical and biological treatment occur (sand filter for physical, and bioballs for biological treatment.)
 - For slum community, only treatment bucket was used.
 - Before fabrication, efficiency of treatment system was tested by monitoring COD of treated 'synthetic wastewaters and wastewater similar to food vendors'. This is to determine type of treatment to be used i.e., aerobic or anaerobic.
 - Aerobic treatment done with initial influent concentration of 500, 1000, 3000 mg/L at HRT = 5-12 hrs, 17-25 hrs.
 - Anaerobic treatment, HRT = 24 hours



Methodology

❑ Monitoring of Installed Units

- Total of 36 units installed (21 for food vendors, 15 from slum community)
- Monitoring done at 8 floating food vendors
- Parameters for monitoring : BOD, TSS, oil and grease, pH
- To ensure proper operation of the system and create environmental awareness, a booklet in Thai was produced



Methodology

□ Workshop

Two workshop organized

- First one to introduce the project to food vendors and community and to get response from the stakeholders
- Second workshop was conducted to explain the operation of the treatment unit



Workshop



Results



Survey Results

❑ Floating Food Vendors

- Food restaurants along the Klong and operates from late morning till evening
- About 32 vendors in Klong 1-5
- Are family- owned and for some whole family lives in the boat
- Use water for drinking, bathing, clothes washing, dishwashing and sanitation
- Water sources: bottled water (for drinking), tap water, klong water
- About 44% use Klong water for cleaning, especially for dishwashing (60 – 400 L/vendor)
- About 66% discharged wastewater pre-treated using oil skimmer
- About 34% have proper sanitation facilities
- Health condition is normal

Survey Results

❑ Slum Community

- Called “Bahn Sum Raan” consist of 30 households with total population of 90
- Use water for drinking, bathing, clothes washing, dishwashing and sanitation
- Water sources: bottled water (for drinking), tap water, klong water
- Wastewater discharged into klong without treatment.
- Most have sanitation facilities
- Health condition is not good
- Community suffer frequently from skin diseases, respiratory and intestinal tract diseases.

Water and Wastewater Characteristics

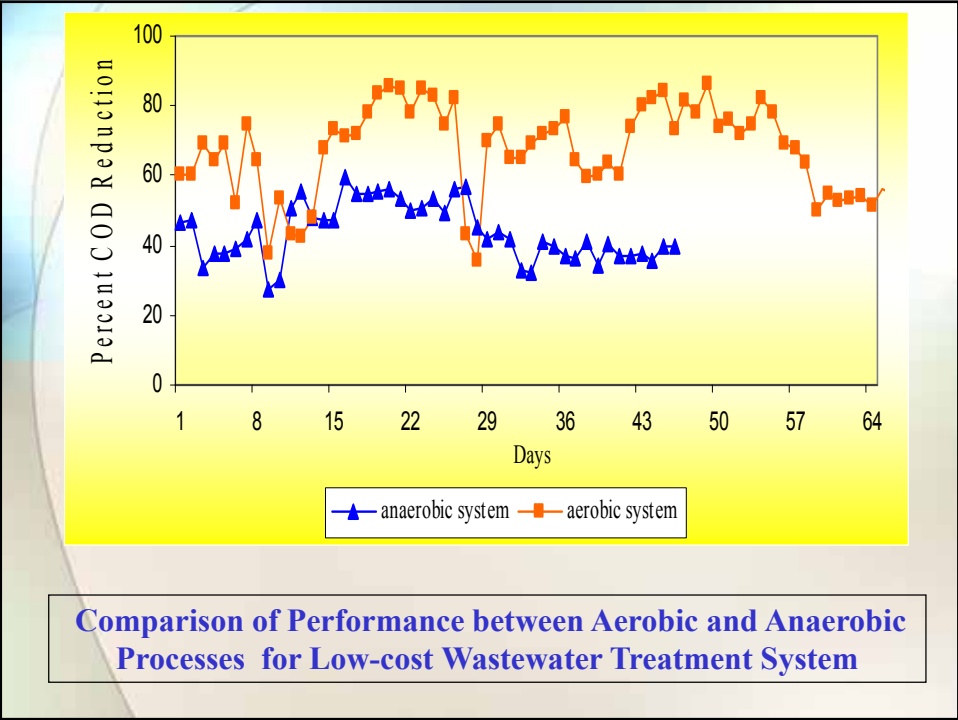
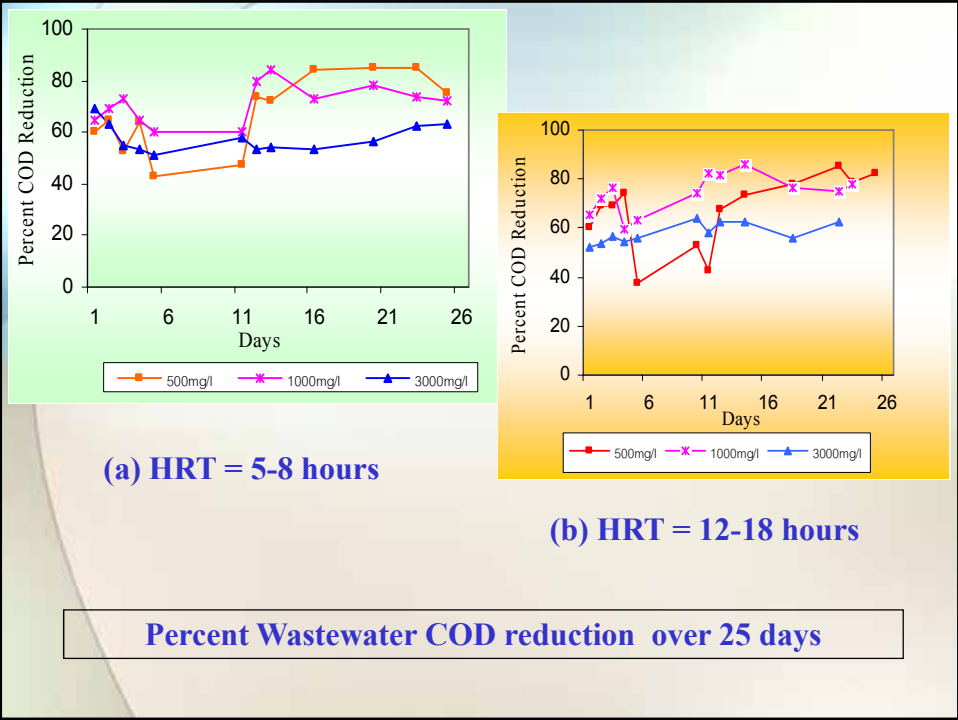
Parameters	Klong water	Wastewater from food vendors	Surface water quality standard (Class 3)	Building effluents standard
pH	6.7 -7.0	4.2 – 7.2	5-9	5-9
DO, mg/L	0.6 – 2.4	-	4	-
BOD, mg/L	3-8	100- 2,100	2	200
TSS, mg/L	7-19	12-14,100	-	60
TS, mg/L	260-400	300 – 15, 400	-	-
TDS, mg/L	240-400	300 – 6,100	-	-
TKN, mg/L	2.8-4.2	2.8 – 4.2	-	-
Oil and Grease, mg/L	-	2 – 12,800	-	100
Total Coliform, MPN/100 mL	$7 \times 10^7 - 1.5 \times 10^9$	$4.3 \times 10^6 - 1.1 \times 10^{10}$	20,000	-
Faecal Coliform,	$3.0 \times 10^7 - 7 \times 10^7$	$7.5 \times 10^5 - 9.3 \times 10^8$	4,000	-

Water and waste water characteristics

- Analysis of water from klong indicates low DO and high BOD making water unsuitable for use as class 3 (medium clean fresh water resources)
- High amount of nitrogen may lead to rapid growth of algae
- Large number of total and fecal coliform indicate fecal contamination from human and warm blooded animals
- High values of BOD, TSS, oil and grease exceed the local building effluent standards (200, 60 and 100 mg/L) in wastewater from floating food vendors
- Oil skimmer used by some food vendors do not function properly



Design of Low-Cost Wastewater Treatment System



Aerobic vs Anaerobic system

Aerobic system:

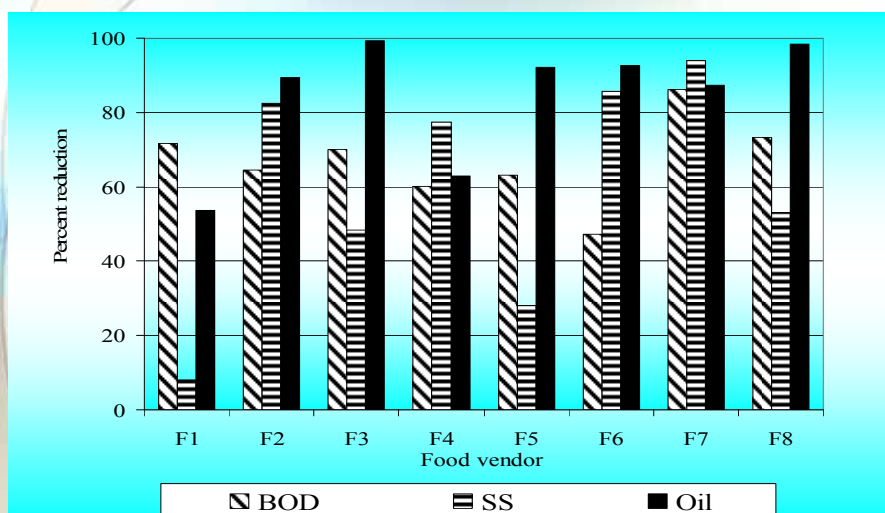
- Average COD reduction achieved was 80%, 75%, and 60% for influent concentration of 500 mg/L, 1000 mg/L and 3,000 mg/L, respectively
- HRT tested does not affect performance of system
- Oxygen requirement makes process more expensive
- Despite limitation, aerobic system still affordable at US\$ 172 (with oil skimmer) and US\$ 110 (without oil skimmer)

Anaerobic system:

- Average COD reduction achieved was only 40% at HRT = 24 hrs
- Cause unpleasant odor

Therefore, Aerobic system was selected for fabrication of low-cost wastewater treatment system

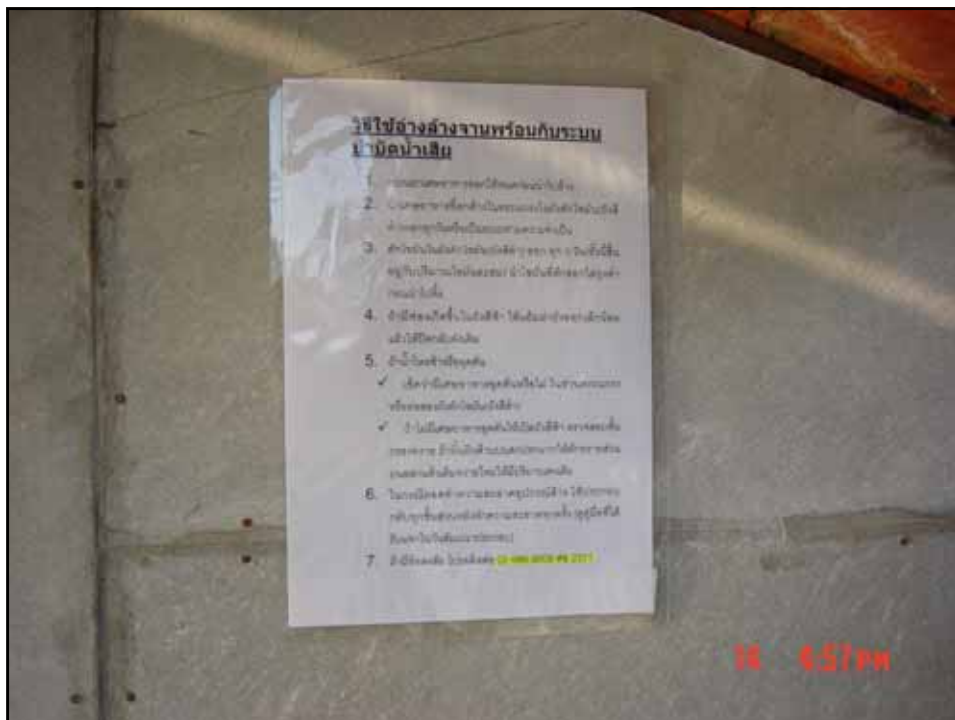
Monitoring Results



Percent Reduction of BOD, Oil and Grease and TSS of the Low-cost Wastewater Treatment Systems from Food Vendors F1 – F7

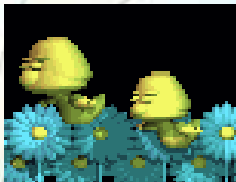
Monitoring Results

- Showed wide variation
- BOD reduction ranged from 47.2% for F1 to 86.2% for F7
- Oil and grease reduction ranged from 53.7% from F1 to 99.2 for F3
- Highest system performance was achieved from units with proper maintenance, adequate aeration and long operation time
- Instruction in Thai were prepared with simple steps of operation and posted near unit



Conclusion

1. Wastewater discharged from floating food vendors was found to be highly contaminated and therefore have to be properly treated before discharge to the Klong water
2. Low- cost wastewater system seemed to function as designed despite constraints in size, irregular wastewater flow pattern, and fluctuation in wastewater quality
3. Treatment achieved for low-cost wastewater treatment system: 86% BOD reduction, 99.2% oil and grease reduction, and 99.9% SS reduction.
4. For a more effective performance of the system, proper maintenance seemed to play a major role.
5. Fabrication of more treatment units can be done for use by other food vendors in water canals throughout Thailand.



End of Presentation... Thanks!

