

**Benzene toxicity to the scallop,  
*Chlamys farreri*, and the shrimp,  
*Penaeus japonicus***

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# Oil spill risk

- The world today produces and consumes a huge number of petroleum and its refinery products, among which fuel oils ranking top.
- As the petroleum products are shipped on sea with tankers, accidents may occur and result in oil spill.
- Oil spills > 1000 barrels (136 MT):  
Events > 740 since 1974  
Volume amounted >  $0.45 \times 10^6$  MT in the last decade (ETC, 2003).

# Benzene risk

- BTEX include: **benzene** and its alkyl homologues
- BTEX are abundant components in the spilled petroleum and gasoline
- BTEX, nonpolar organic compounds, have nonspecific toxicity, cause nonspecific narcosis above certain level in tissue (particularly membrane) lipids
- Predicted LC50 of BTEX:  
48 mg/L (benzene) ~ 7.2 mg/L (*m*-xylene)  
According to the regression relationship (McCarty et al. 1992) between aquatic organisms and physical/chemical properties of nonpolar organic chemicals with nonspecific toxicity of narcosis.
- BTEX concentration in water chemically equilibrated with the gasoline at room temperature: ca. 120 mg/L (Zogorski et al. 1996)
- BTEX are the most concerned monoaromatic hydrocarbons in the environment, although not persistent in seawater and with low potential to bioaccumulation
- Limited information on toxicity of BTEX to aquatic organisms.

# Test organisms in this study

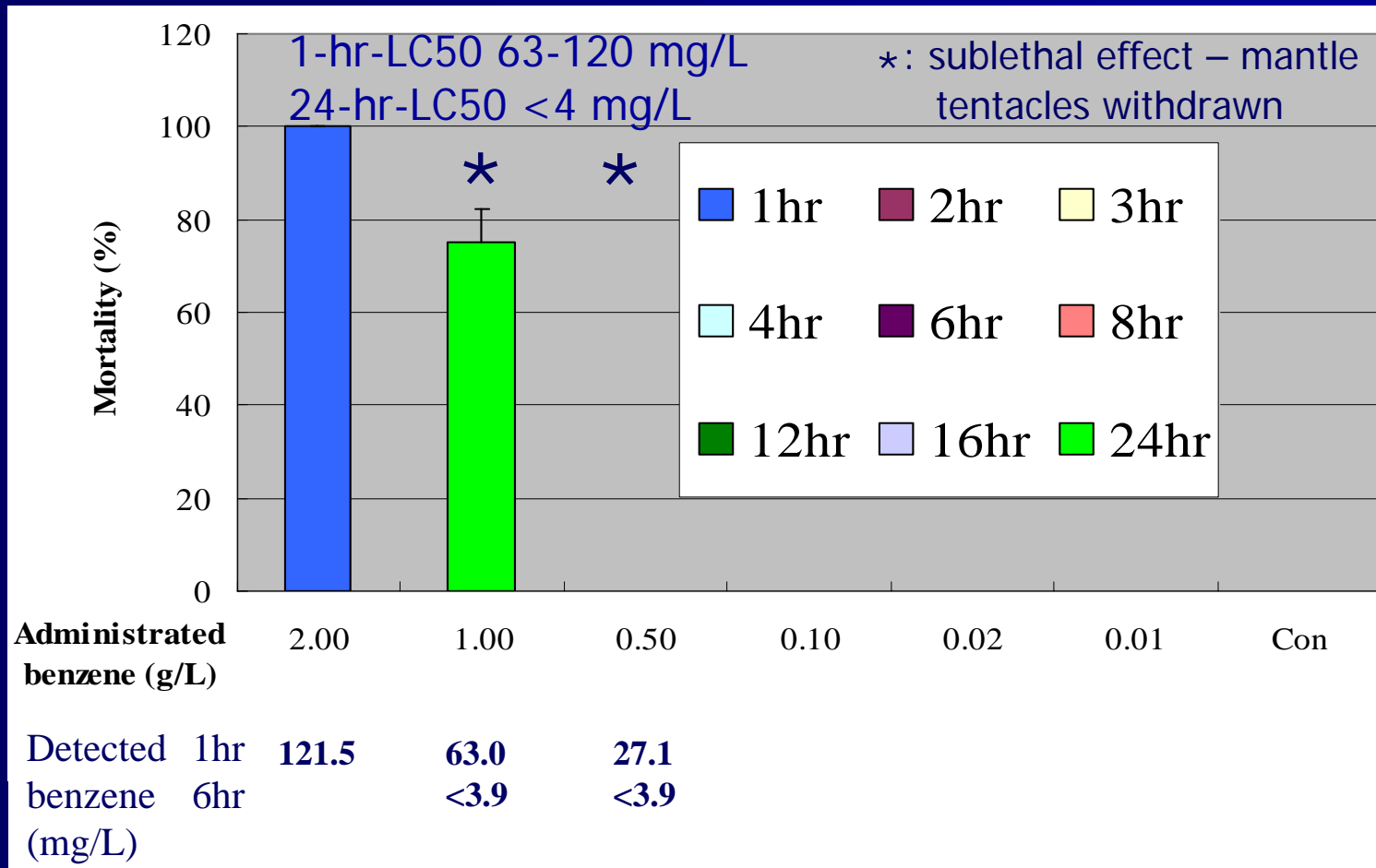
- Scallop (*Chlamys farreri*, SL  $30.4 \pm 1.7$  mm) and shrimp (*Penaeus japonicus*, L  $88.6 \pm 4.8$  mm)
- Representing major types of animals (filter-, nonfilter- feeding) in China's coastal culture
- Subject to oil spill/benzene releasing

# Experimental setup

- 4L seawater in cubic glass tanks, 300 cm<sup>2</sup> by 13 cm (H)
- 10 animals in each tank, with gentle aeration, two replicates for control and treatments
- Seawater temp 20.5°C, salinity 34 psu
- Dissolved benzene concentration was monitored (GC-7AG)



# Benzene toxicity to the scallop



# Comparison of known toxicity of benzene to aquatic organisms

Indicator	Toxicity	Data source
EC50	41 mg/L (reduced microalgal growth)	Herman et al. 1991
EC50	70.3 mg/L (impaired macroalgal reproduction)	Thursby & Steele 1986
EC50	0.1 mg/L (invertebrate early development failure)	Pagano et al. 1988 Chicu & Barking 1997
EC50	<27 mg/L (inactivity of scallops)	This study
LC50	>1000 mg/L (rotifers)	Ferrando & Andreu-Moliner 1992
2-hr-LC50	20 mg/L (finfish)	Meyerhoff 1975
1-hr-LC50	13 mg/L (shrimp)	This study
	63-120 mg/L (scallop)	
24hr-LC50	<4mg/L (scallop)	This study
Empirical LC50	35.4 mg/L	EPA 1997
Predicted LC50	48 mg/L	McCarty et al. 1992



# Summary

- Shrimps are more sensitive to benzene toxicity
- Benzene toxicity to shrimps and scallops is in the lower range of known benzene toxicity to aquatic organisms

Thanks  
for your  
attention