

The Use of Fly Ash to stabilise The Low Levels of Mercury in The Environment

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Out line

- Introduction (Mercury and Fly ash)
- Aim of study
- Methodology
- Result and discussion
- Conclusion
- Acknowledgement

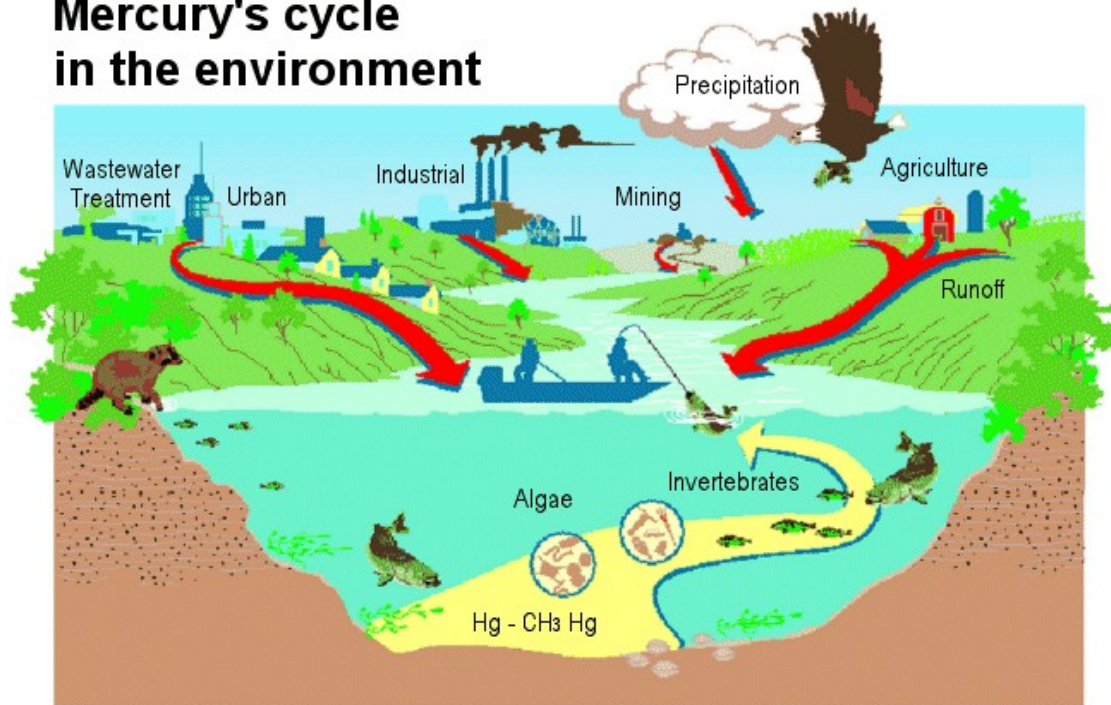
Introduction

- What is mercury?



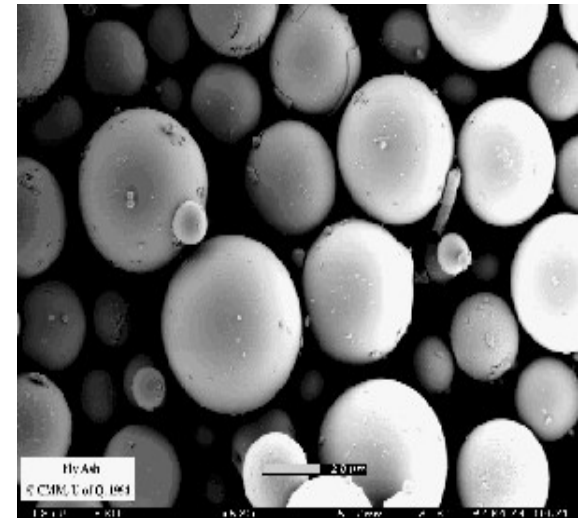
Mercury's cycle in the environment

Mercury's cycle in the environment



(Illustration by Connie J. Dean, U.S. Geological Survey)

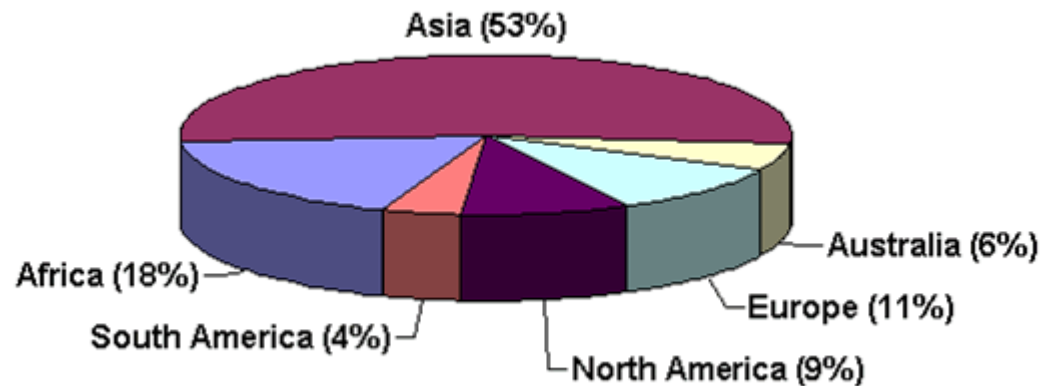
- What is fly ash?



Why we interested in this area?

- 1) Large amount of fly ash
- 2) Mercury is widely spread in the environment
- 3) Mercury is very high toxic: Minamata disease, for example, was an effect of mercury poison. More than 100 people were poisoned after eating sea food containing high concentration of methylmercur(27-102 ppm d.w.)

Mercury Emission



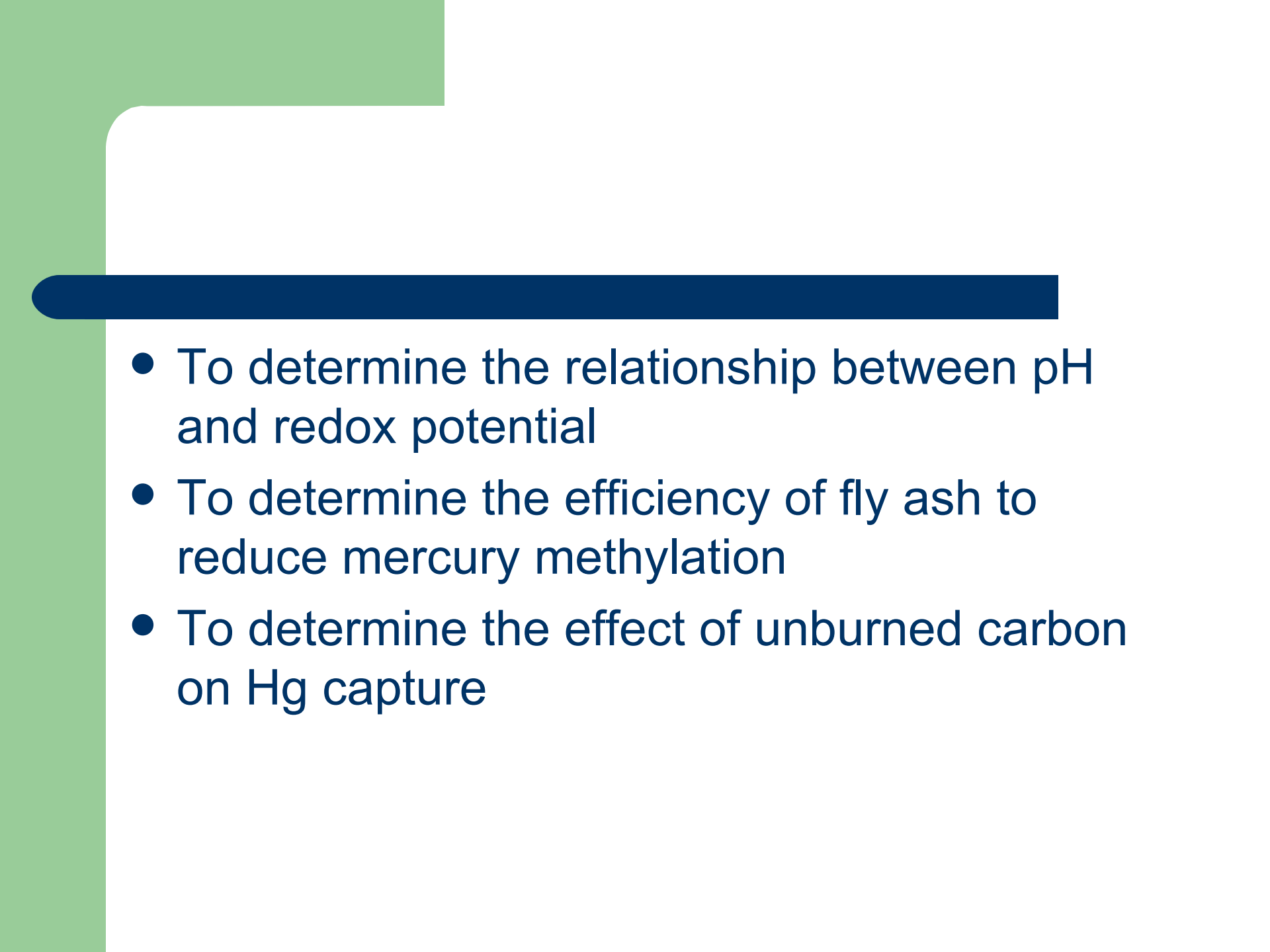
Mercury emission in different parts of the world

Source: Presentation by J. Pacyna and J. Munthe at mercury workshop in Brussels, March 29-30, 2004

Aim of the study

- 1) To determine the effectiveness of fly ash in adsorbing and stabilising low concentration of mercury in the environment
- 2) To investigate if fly ash can reduce the bioavailability of Hg for methylation under anaerobic condition

- To determine adsorption/desorption kinetic of Hg
- To construct adsorption isotherm
- To determine a maximum capacity of Hg adsorbed onto fly ash
- To determine factors affecting the adsorption of Hg onto fly ash

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- To determine the relationship between pH and redox potential
 - To determine the efficiency of fly ash to reduce mercury methylation
 - To determine the effect of unburned carbon on Hg capture

Methodology (2 Parts)

Part I: Fly ash stability to physical condition

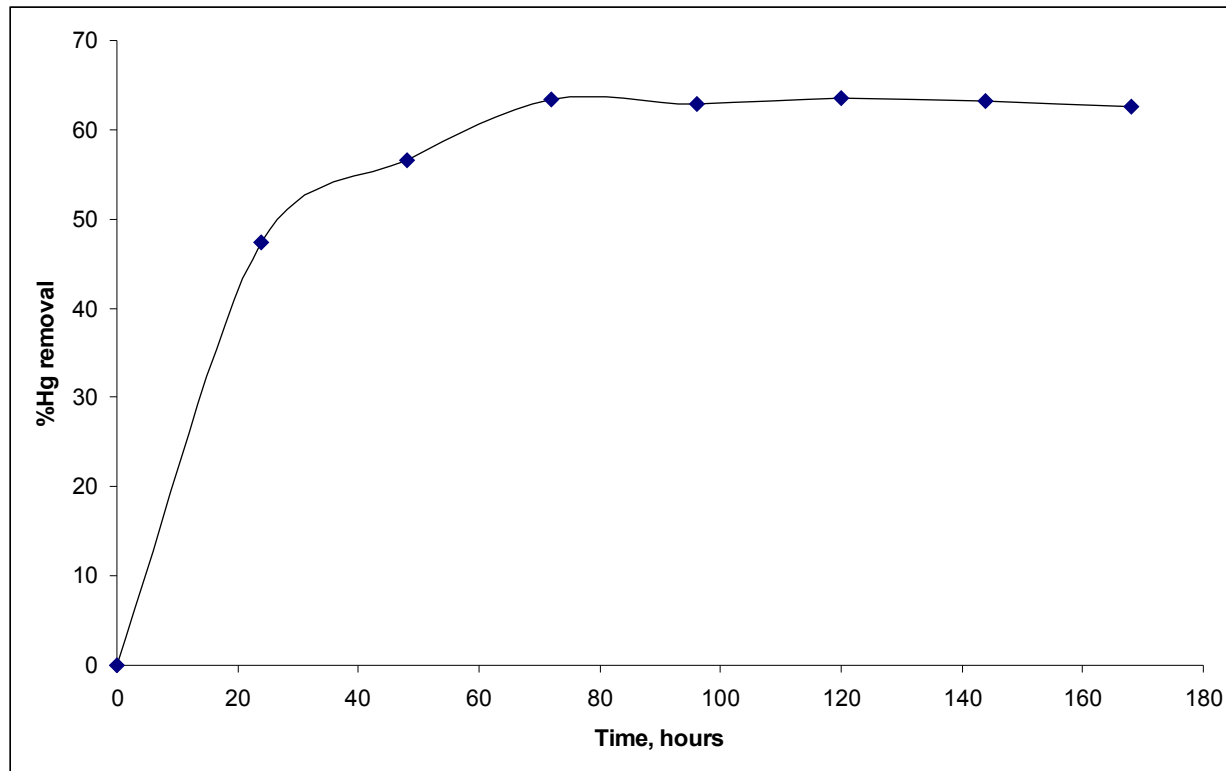
- Batch Test
- Adsorption equilibrium
- The optimize condition: Contact time, pH and fly ash dosage
- Method of mercury analysis
 - Atomic fluorescence spectrometry

Methodology (continue)

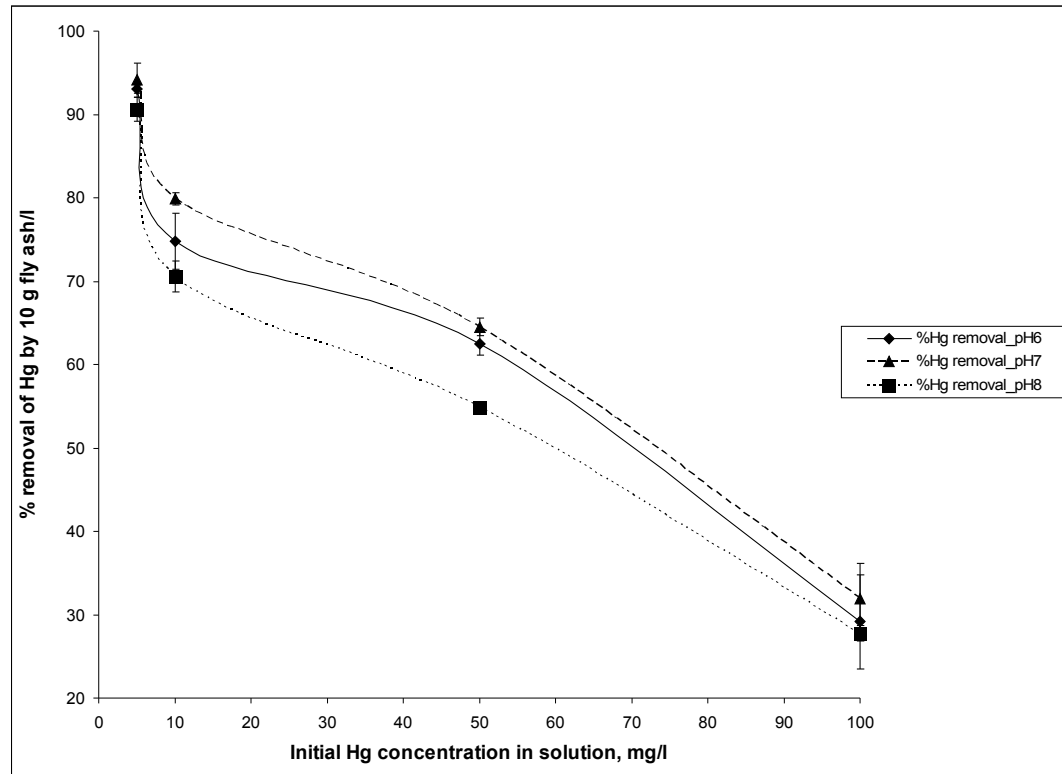
Part II: Fly ash ability to reduce its bioavailability

- Mercury adsorption onto fly ash under anaerobic condition with organic rich sediments

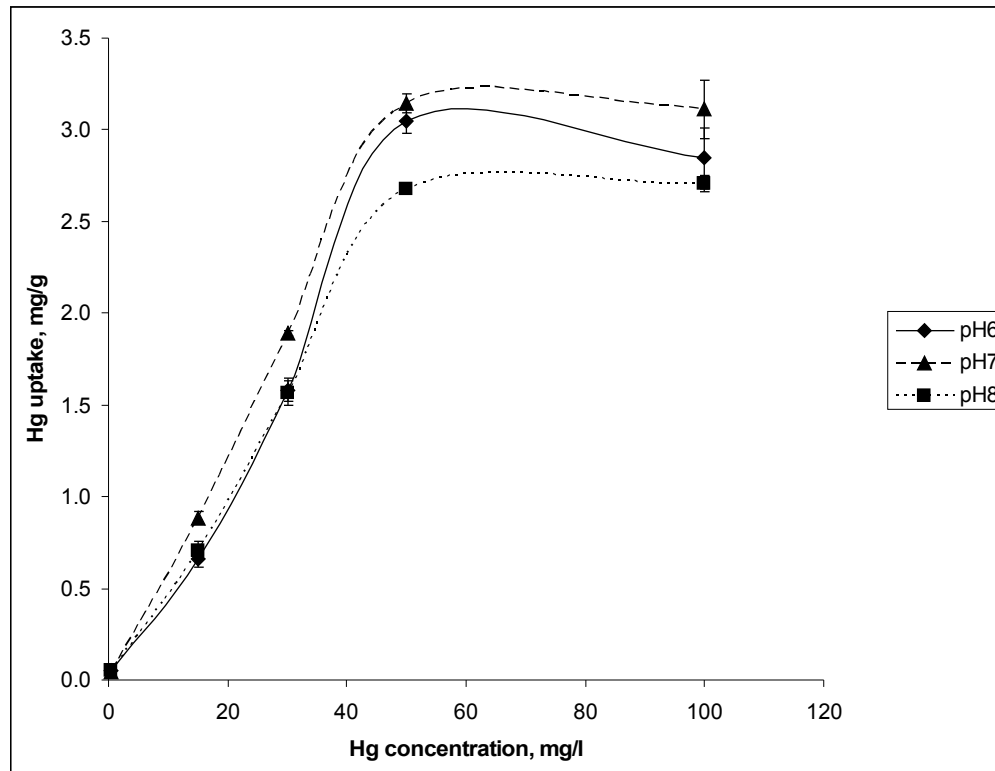
Results : Adsorption equilibrium



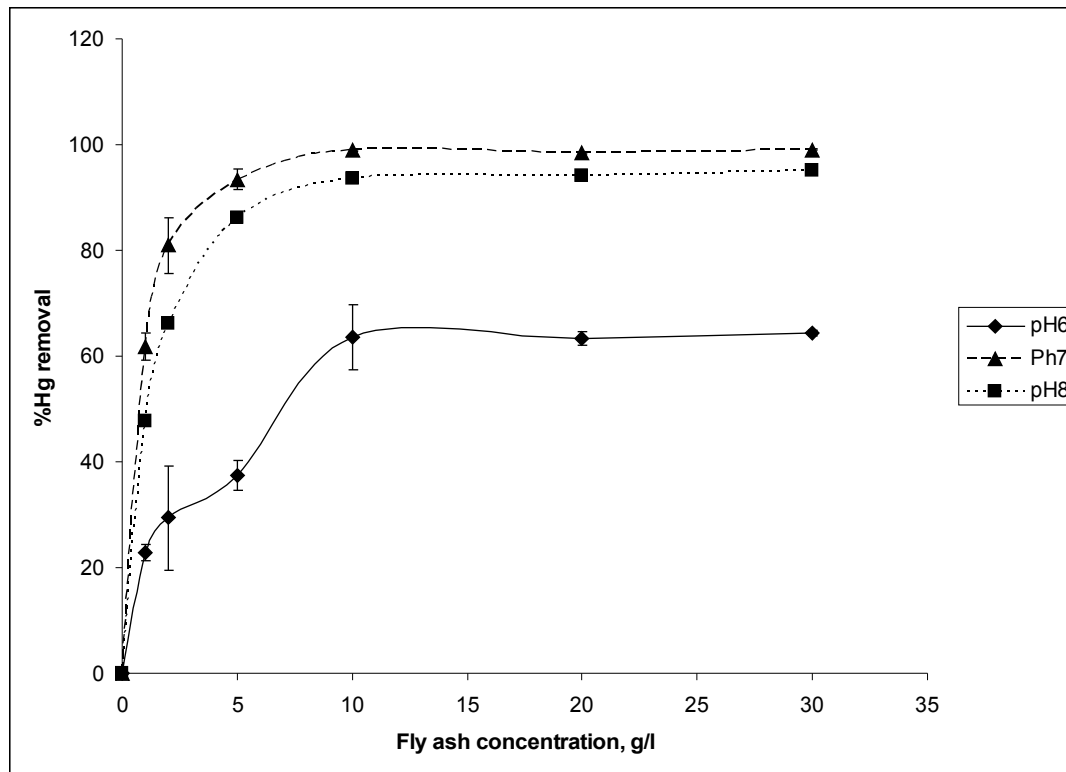
Effect of initial Hg concentration on %Hg removal in 1 g of fly ash at three pHs, 100 ml of solution



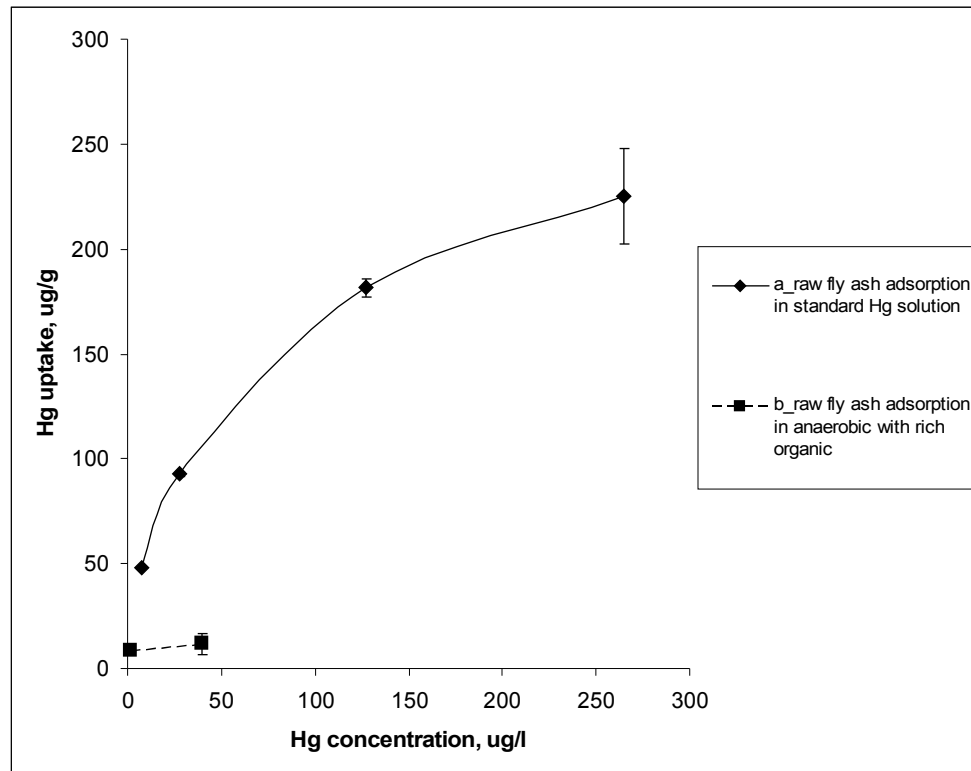
Up take of Hg on 10 g fly ash from different initial Hg concentration in 1 l of solution at three pHs



Effect of Fly ash dosage on %Hg removal at 1.5 mg/l of initial Hg concentrations



Effect of fly ash at stabilizing Hg in anaerobic sediments



Conclusion

- The optimum condition for adsorption: pH 7, 40 mg/l of Hg concentration and fly ash dosage 10 g/l (contact time 72 hours)
- Lab studies of the stability of the adsorbed mercury on fly ash when mixed with organic rich sediments in an anaerobic environment showed that despite ideal conditions for methylation to take place after 8 weeks the concentration in solution was less than 2 $\mu\text{g/l}$.
- Fly ash has ability to stabilize low levels Hg in the environment

Future Work

- Pilot scale: Natural Environment, Wastewater treatment plant (High Hg concentration)
- Application for other power station fly ash (available in Thailand)

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