

# LABORATORY INVESTIGATIONS OF STABILIZED **NANO SCALE ZERO VALENT IRON** FOR THE TREATMENT OF LANDFILL LEACHATE IN THE TROPICS

**S.S.R.M.D.H.R. Wijesekara<sup>1</sup>, B.F.A. Basnayake<sup>2</sup> and  
Meththika Vithanage<sup>1\*</sup>**

<sup>1</sup>Chemical and Environmental Systems Modeling Laboratory,  
Institute of Fundamental Studies

<sup>2</sup>Department of Agriculture Engineering, University of  
Peradeniya

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# Introduction

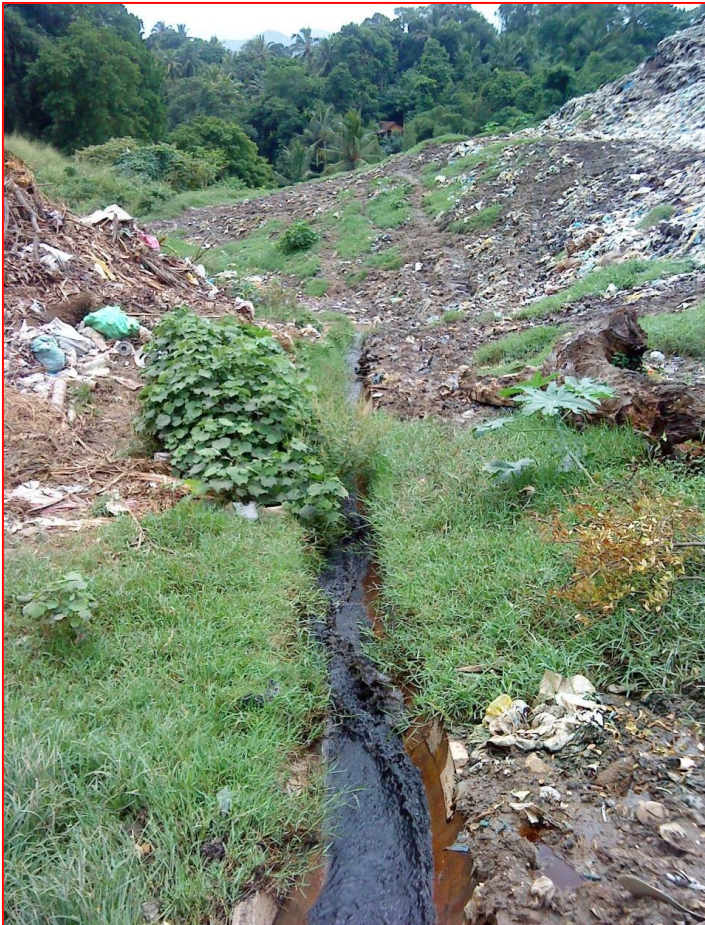
## Municipal Solid Waste Management in Sri Lanka



Gohagoda open dumpsite, Kandy

# Landfill Leachate

The **contaminant liquid** that drain from sanitary landfills or any other waste dumping sites



**Drainage channel stemming from Gohagoda dumpsite**

# Risks to the Environment from landfill leachate

- Mainly from high organic concentrations
- High heavy metal concentrations
- Spreading diseases via pathogens' etc

When it releases to the environment, several environmental issues can arise such as, **contamination of surface and ground water, soil and air pollution** (Sun et al., 2000)

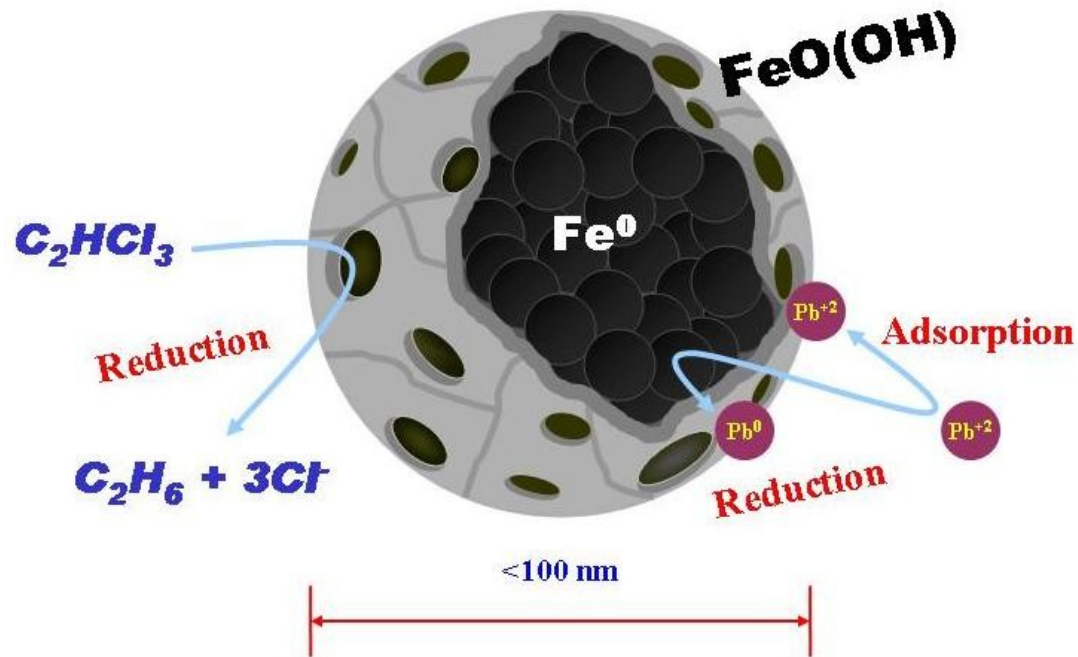
# Solutions

Several chemical, biological and physical treatment methods are using for leachate treatment worldwide

- Coagulants
- Biological aerated filters
- Constructed wetlands
- Anaerobic digestion reactors
- Physicochemical methods in combination with adsorption process

Blowes et al., 2000

# Nano Zero Valent Iron (NZVI)



The core-shell of zero valent iron nanoparticles

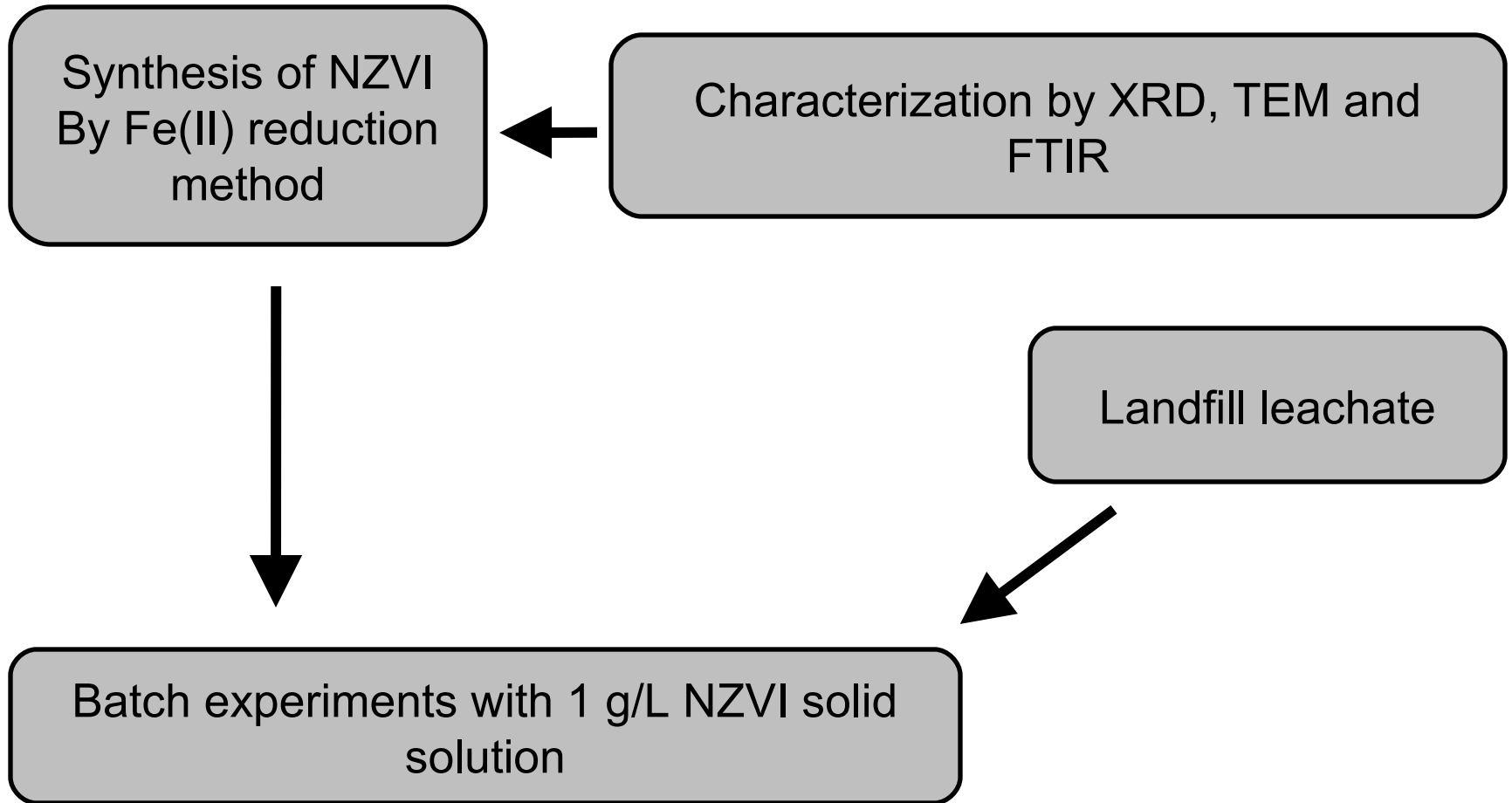
# Objectives

NZVI has been well studied for the treatment of inorganic contaminants in landfill leachate and polluted plumes world wide

But not for organic contaminants removal in detail

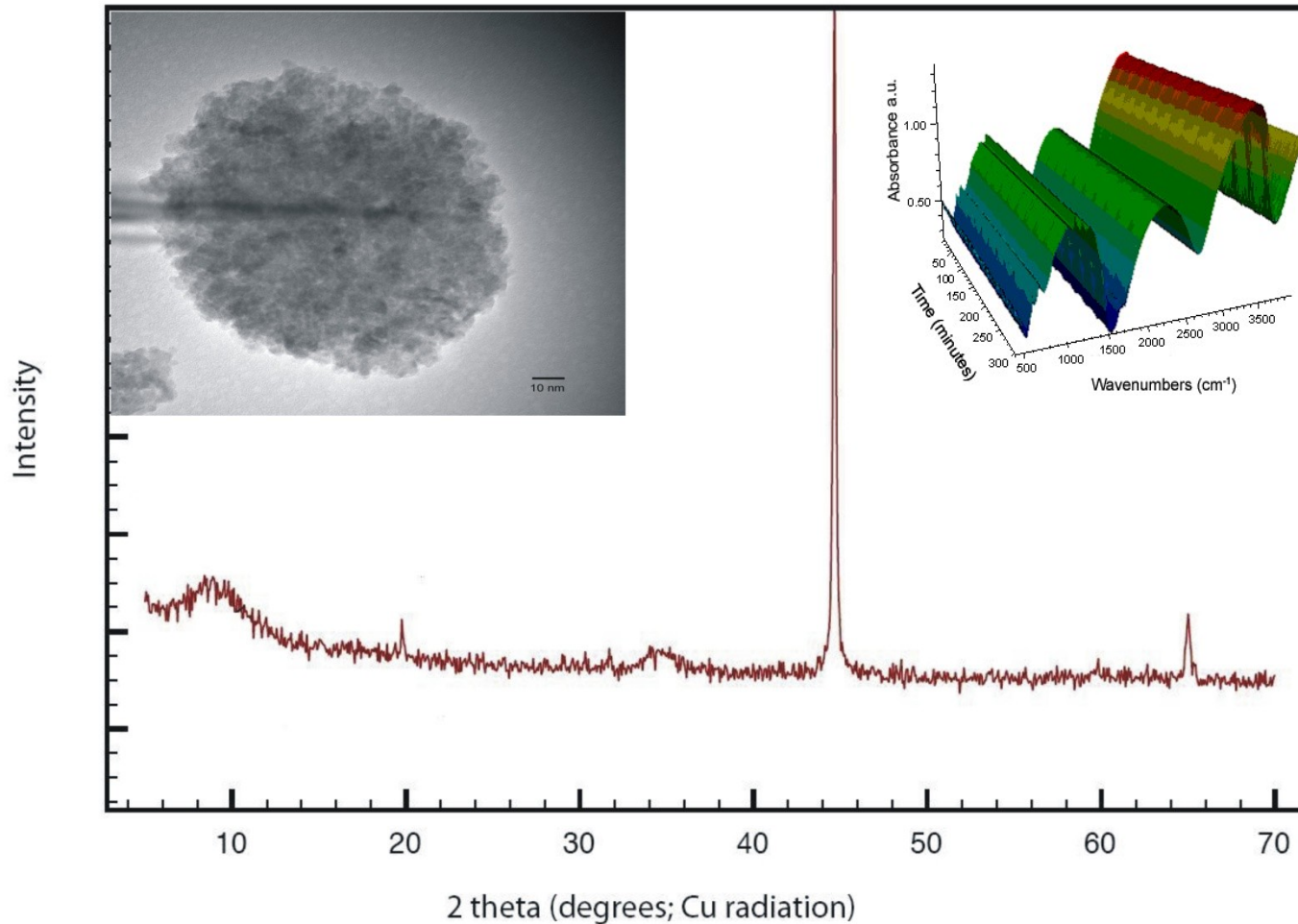
- Synthesis and characterization of NZVI
- Examine the reduction of Nutrients ( $\text{NO}_3^-$  and  $\text{PO}_4^{3-}$ ) and COD rich landfill leachate in the tropical region

# Materials and Methods



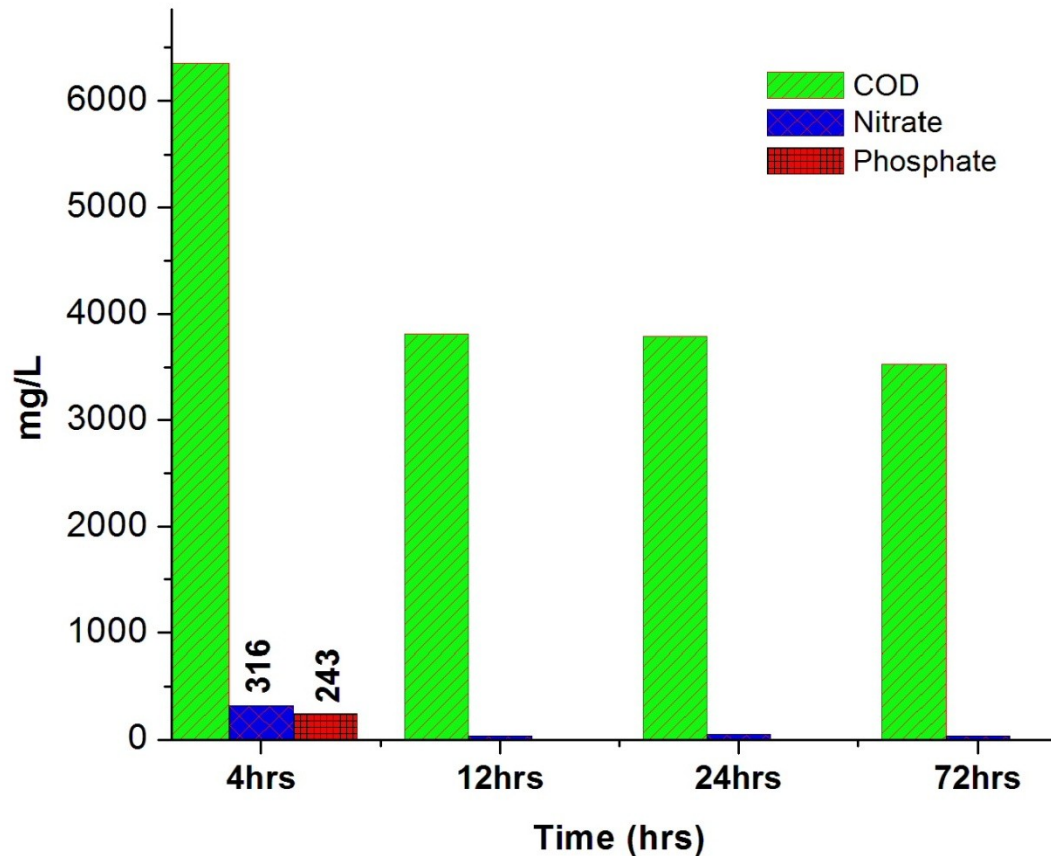
# Results and Discussions

## NZVI characterization



XRD pattern indicates crystallization of Fe<sup>0</sup>, TEM shows ~10 nm particles and FT-IR suggests air stability of synthesized NZVI

## Batch Experiments results



Tested NZVI showed a rapid COD and nutrients removal behavior during the studied period

# Cont..

## COD removal

Mainly due to oxidation-reduction process, adsorption onto and co-precipitation of contaminants with iron corrosion products (Lai et al., 2007)

Break down of organics by metal ion, the very high surface area of the nanoparticles may also effect for removal of COD via adsorption (Jun et al., 2009)

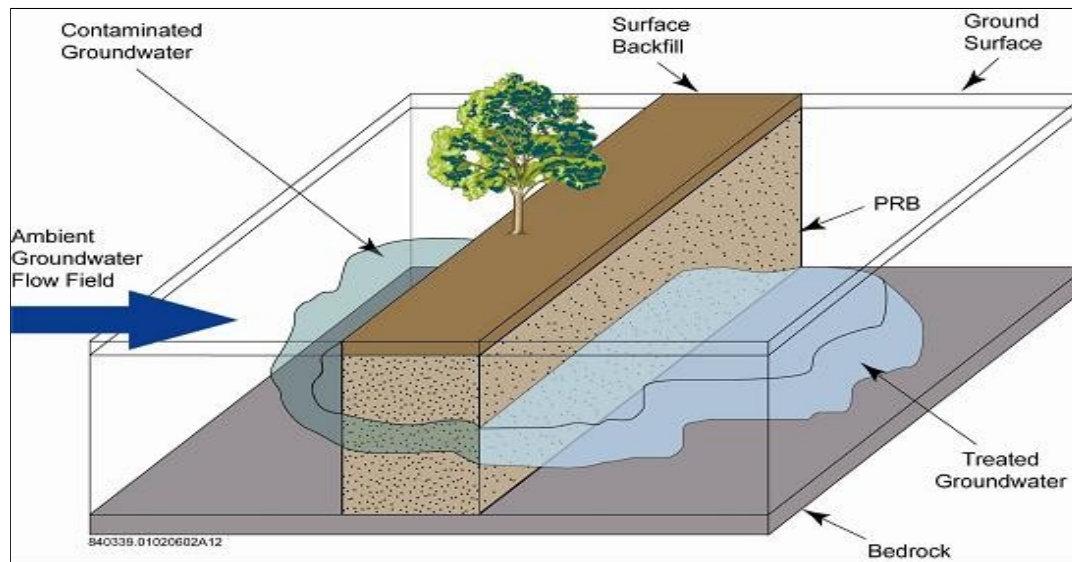
## Nutrients removal

Nitrate removal process could mainly associate with oxidation-reduction reactions

Posphate has strong tendency to be adsorbed on metal surfaces and precipitated with iron species

# Conclusions and Recommendations

- XRD and TEM confirmed the presence of NZVI
- Synthesized performed well for both COD, Nitrate and Phosphate removal indicating 50, 97 and 98 % respectively
- Organic compound modified nanoparticles are effective in treatment of organic rich landfill leachate



# References

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