Innovative sampling technique for monitoring naturally occurring colloidal particles in groundwater

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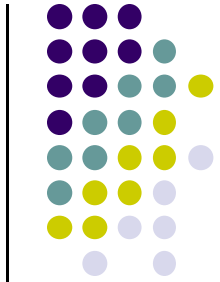

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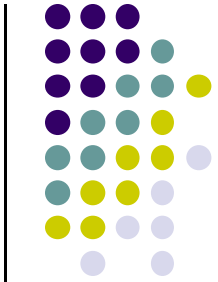


Comparison of groundwater sampling methods

- Bailer

  Adv: Easy and rapid

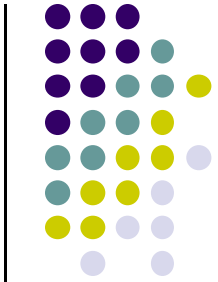
  Disadv: Artificial disturbance

- Low-flow purging

  Adv: Minimal disturbance

  Disadv: Higher cost and longer time

Introduction



Use of 0.45 μm filter to define insoluble (or particulate) and soluble (or dissolved) fractions

- Advantage:

  Easy to operate

- Disadvantage:

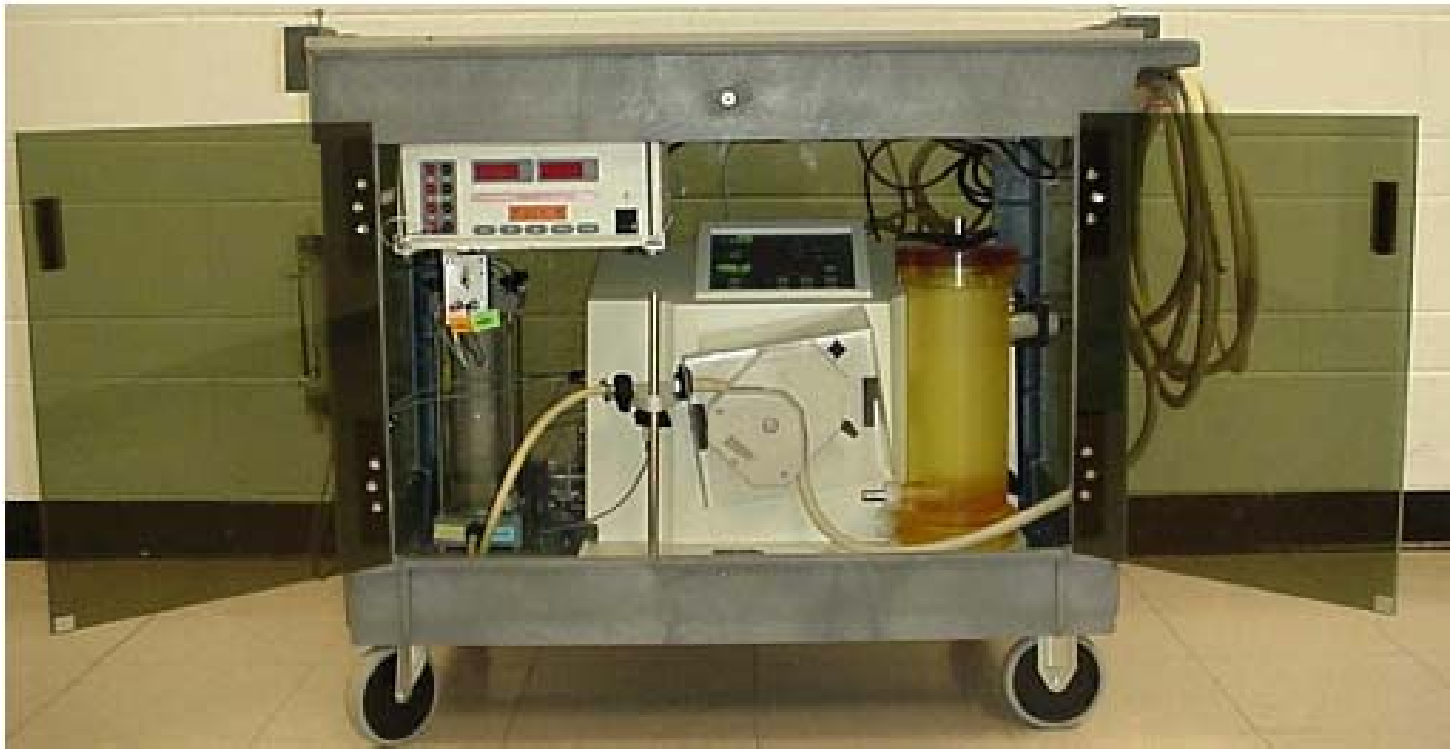
  Clogging

There is a room to develop alternative separation technologies.

Experiments

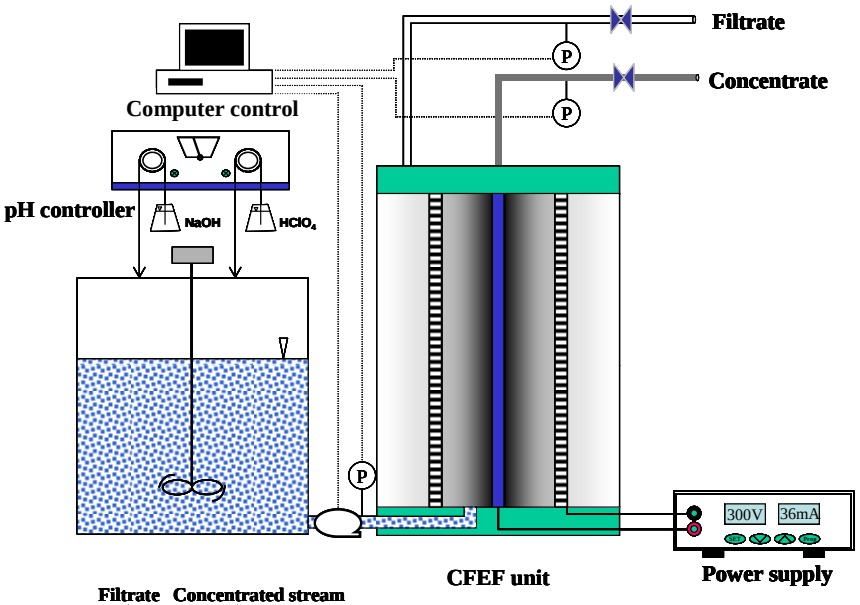
The cross-flow electro-filtration system (CFEF) unit

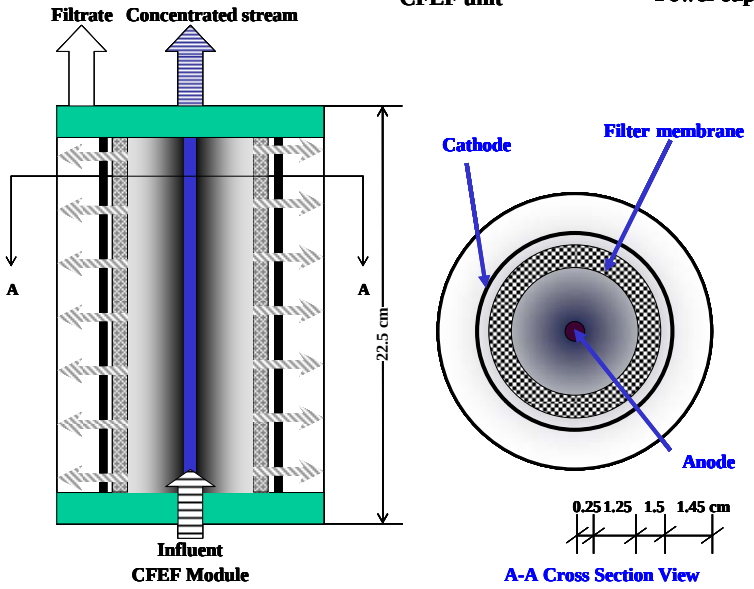
Filtration area 212 cm^2 , Kenmore membrane (10 μm)
Power supply: Model E861, Consor, Belgium

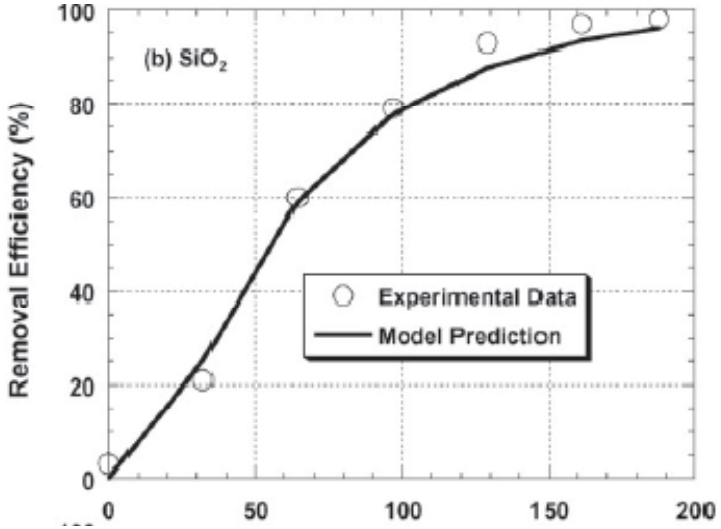


Experiments

Schematic diagrams of cross-flow electro-filtration system (CFEF)







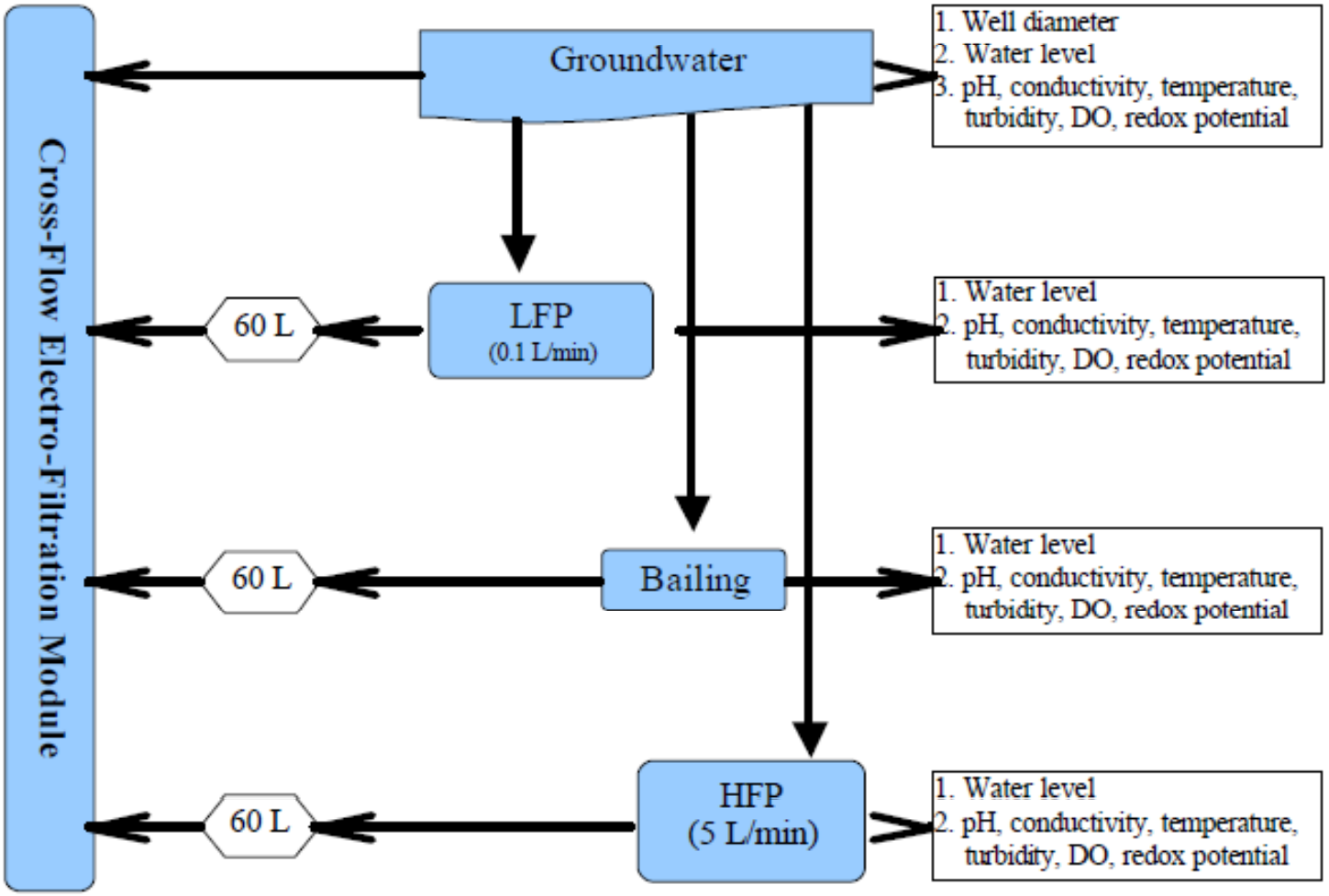
$$\eta = 1 - \exp(-a_1 q_p E_m + a_2 v_r)$$

where $a_1 = pL/3\pi A\mu v_x d_p$ and $a_2 = pL/v_x A$.

Lin et al. (2007)

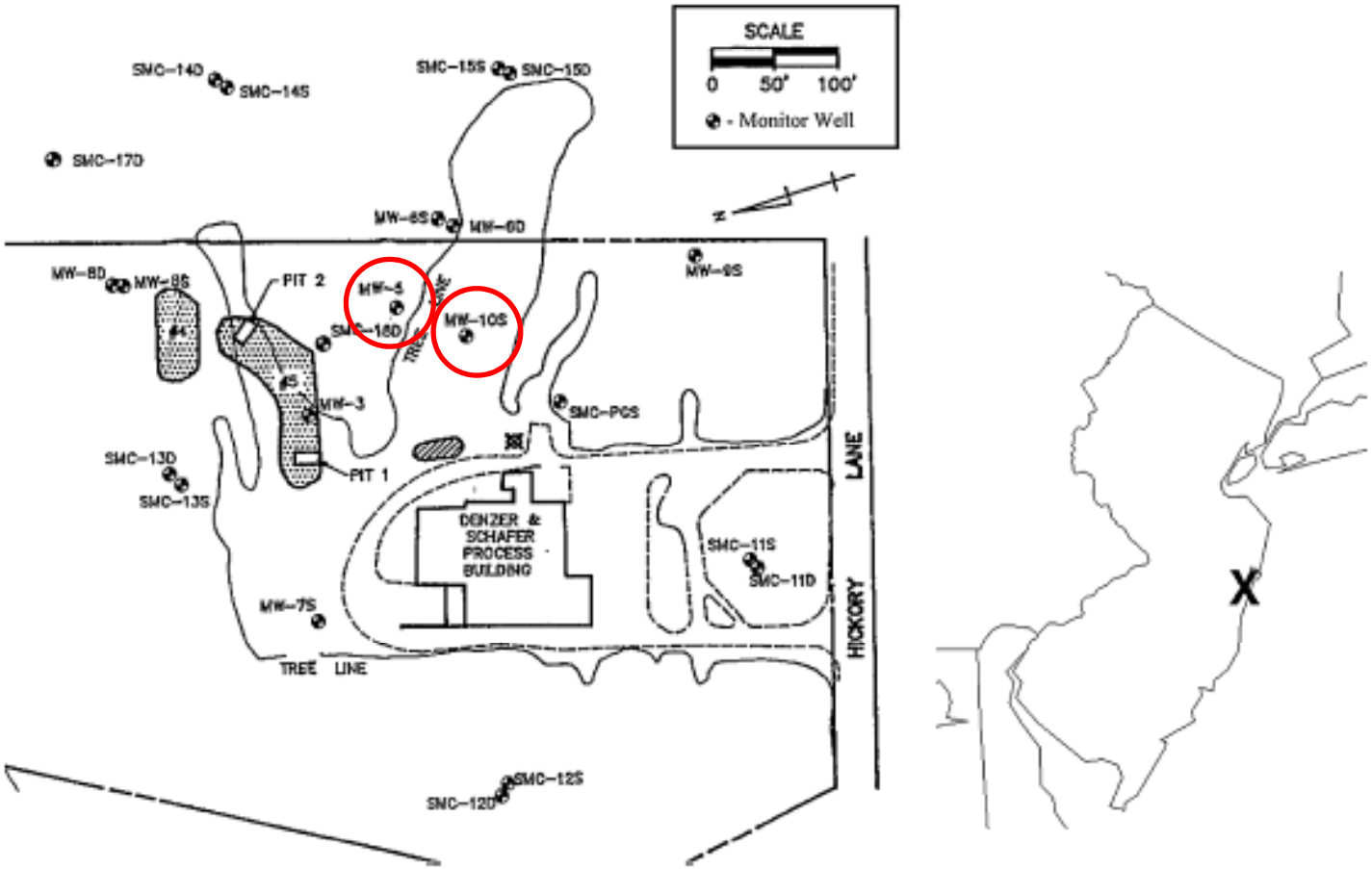
Experiments

Sampling methods



Experiments

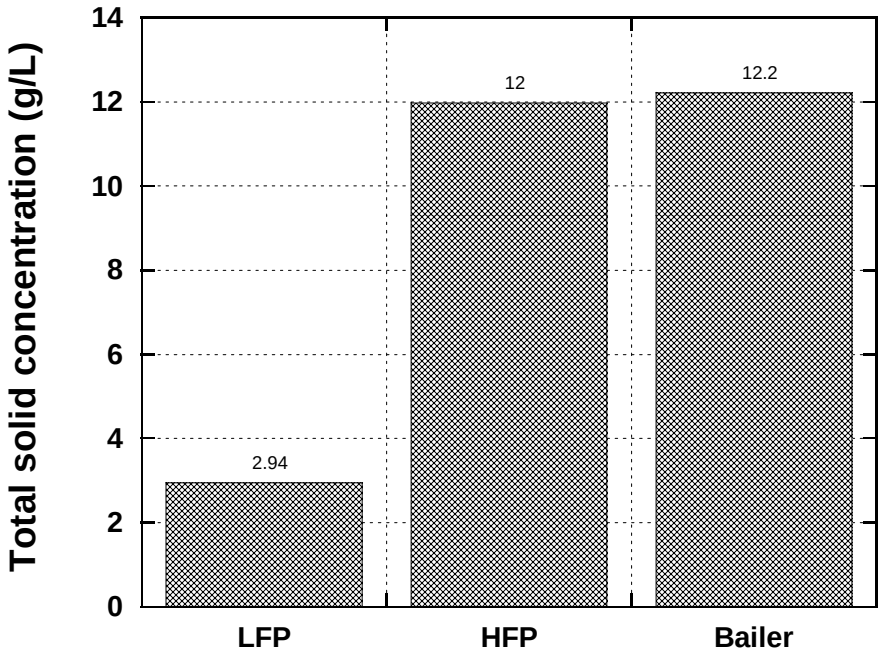
Denzer Schaefer site

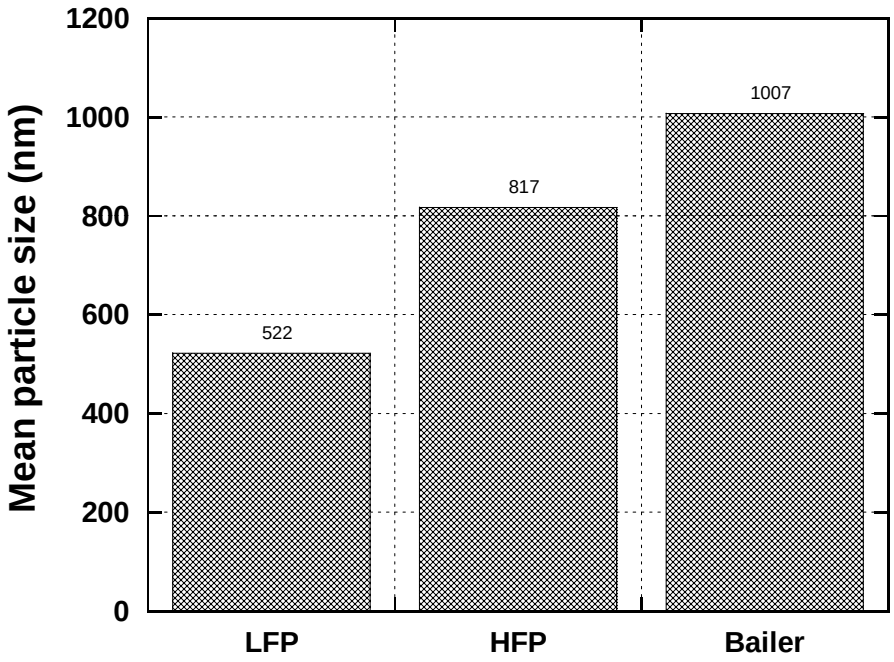


Bailey et al. (2005)

Results and discussion

Effect of the sampling methods on total solid concentration and mean particle size

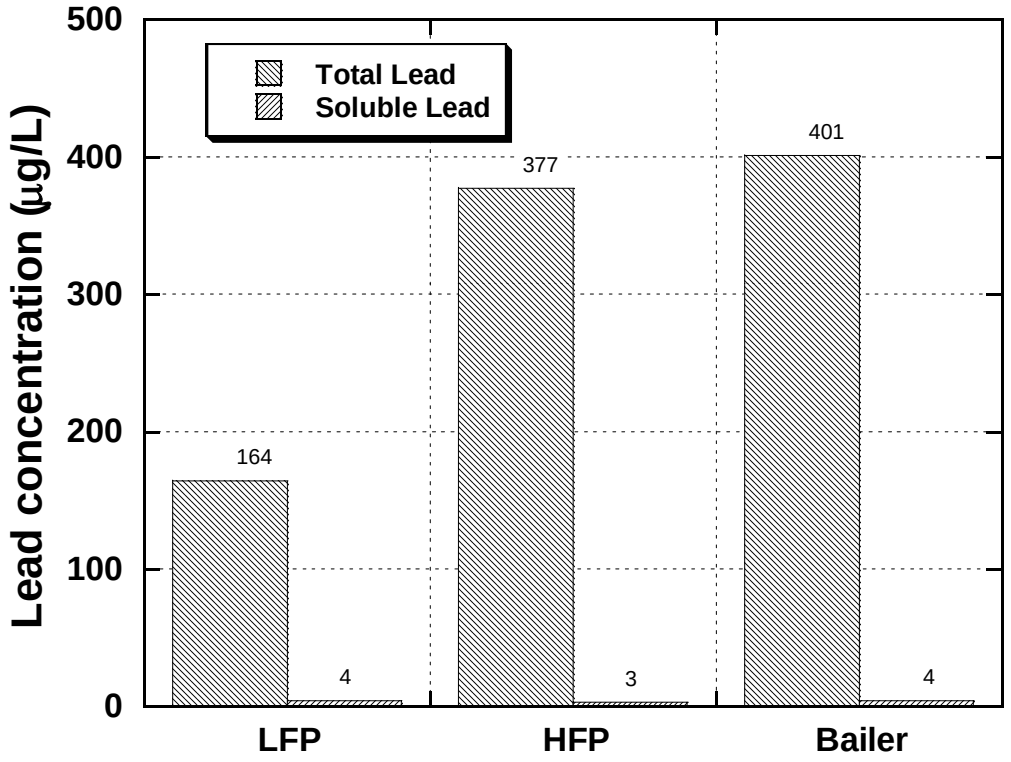


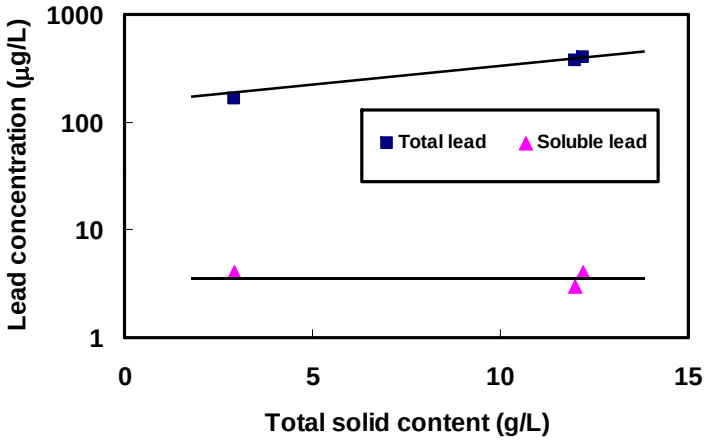


Distribution of colloidal particle size as affected of groundwater sampling methods. Well: #5S. LFP: low-flow-purging; HFP: high-flow-purging

Results and discussion

Effect of the sampling methods on lead concentration

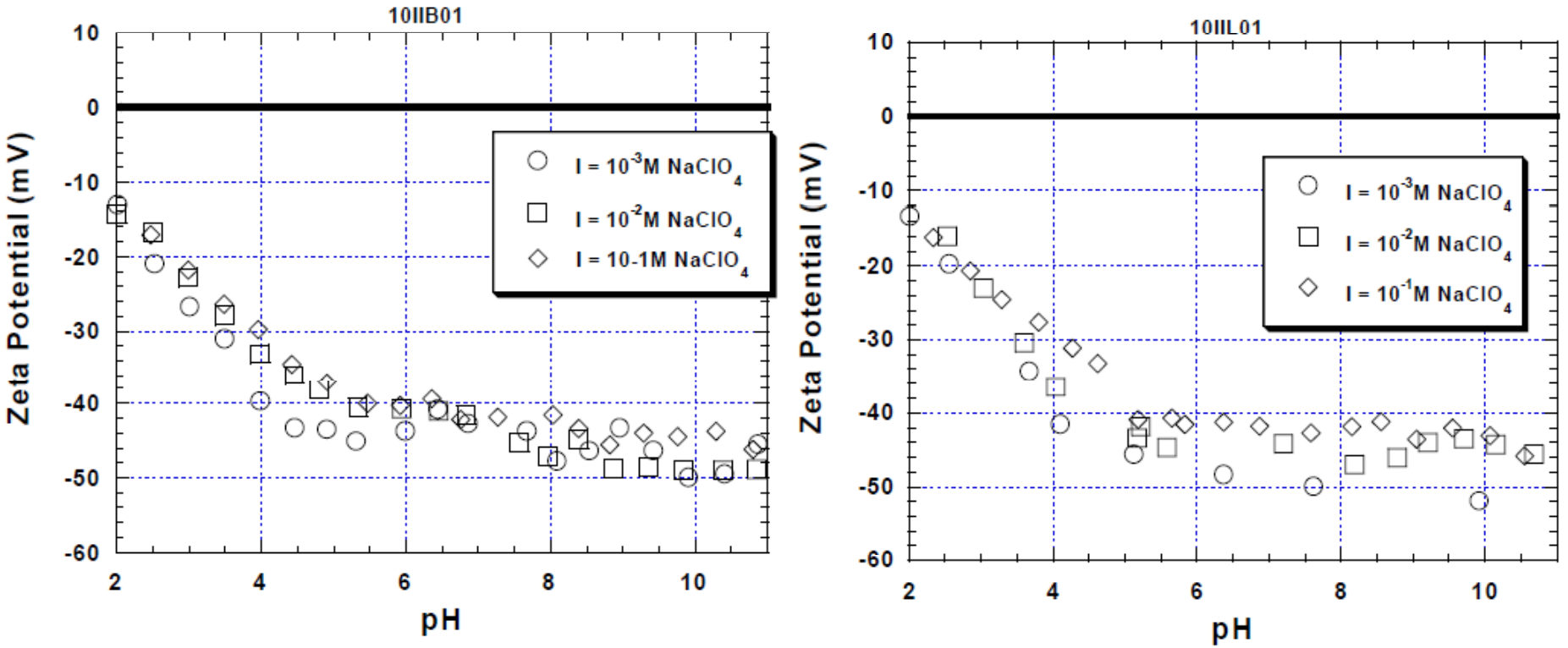




Lead concentration as affected of groundwater sampling methods. Well: #5S. LFP: low-flow-purging; HFP: high-flow-purging

Results and discussion

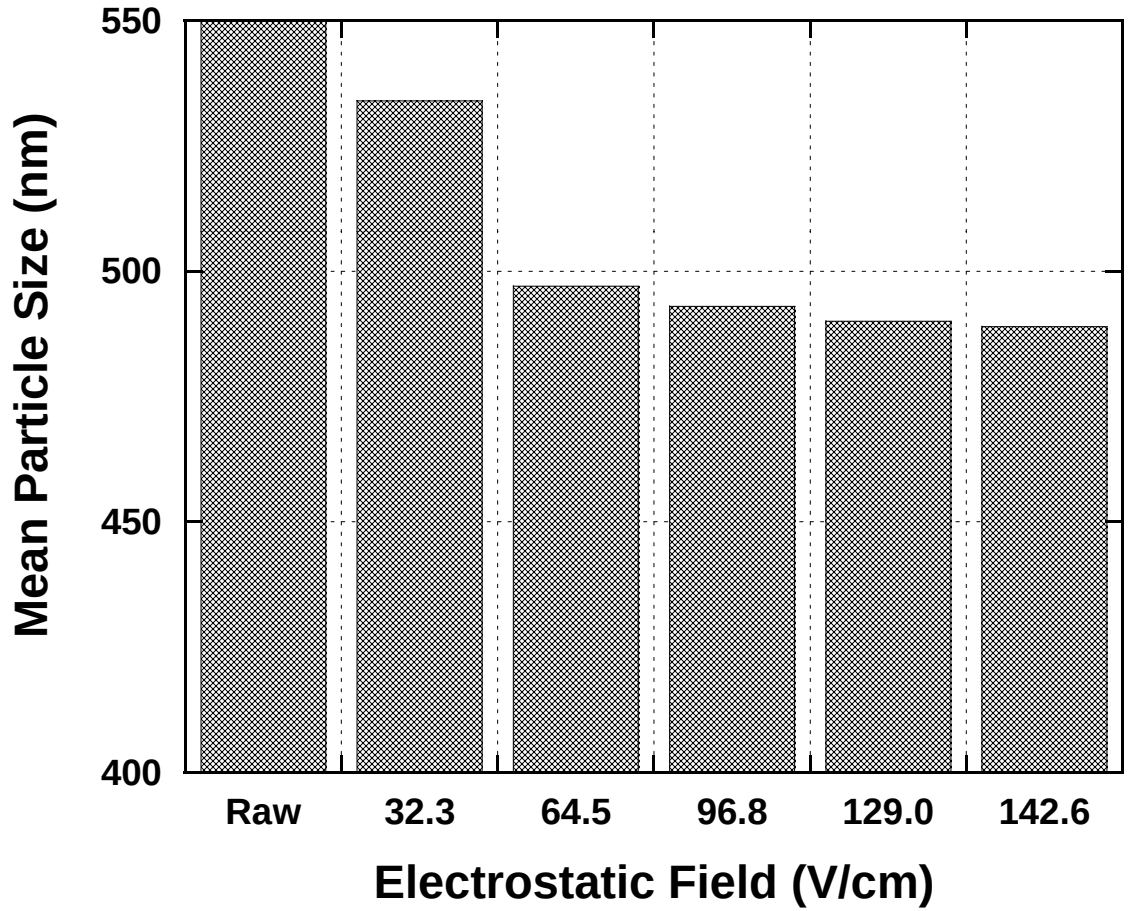
Effect of the sampling methods on zeta potential



Zeta potential of particles from different sampling methods: Well: #10. low-flow-purging (Left); high-flow-purging (Right)

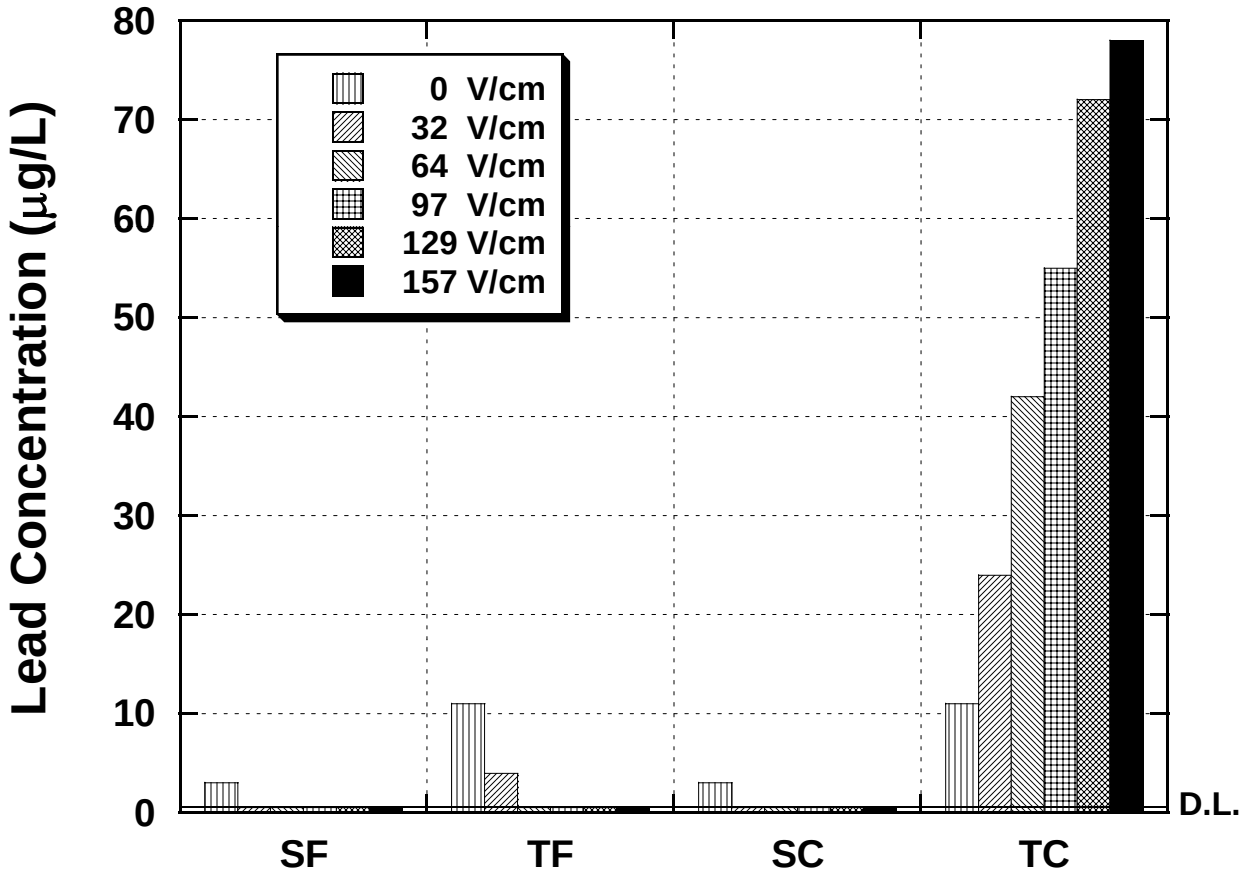
Results and discussion

Effect of the electric field on naturally occurring particles (filtrate)

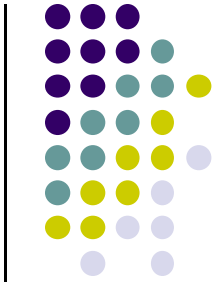


Results and discussion

Distribution of lead concentration as affected by electric field (#5S)



Summary



- Results show that the mean particle size, total solid content, and total lead concentrations of well #5S and #10 collected by low-flow-purging sampling method were less than those collected by bailing and high-flow-purging sampling method.
- From the CFEF process results, the concentration of lead species increases with increasing field strength, that is, the smaller the particles the greater the metal concentration content regardless of sampling method.
- CFEF is able to separate naturally colloidal particles without operational difficulties such as clogging.

Acknowledgements

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Thank you for your attention.

Questions?