**Laboratory Assessment of Nano-Silver Transport in Sand Columns Using Complex Conductivity Measurements**

Dallin Hockens¹, Matt McCaulley¹, Osama I. Abdel¹, Algeria A. Asemwari¹, and Dale D. Winkens²

¹Boone Pickens School of Geology, Oklahoma State University; ²Geology Department, Faculty of Science, Assiut University; ³U.S. Environmental Protection Agency

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**Abstract**

A flow-through experiment was conducted to investigate the capabilities of complex conductivity (CC) measurements in detecting and monitoring the transport of three different concentrations (100, 500, 1000 mg/L) of biodiesel nano-silver (20-100 nm) dispersions in laboratory sand columns. A flow tester was used and the break through curve obtained was of a similar type and shape, indicating similarity in the transport properties of the three sand packed columns. A potentiometric pump was used to introduce the stabilized suspension of nano-silver into the sand column at a rate of 12 ml/hr for 3 h. The pump was stopped every minute for the air bubble to rise and extract the suspensions. The air bubble was then replaced by the next sample and the process was repeated. The time required for the air bubble to reach the exit was recorded using video and analyzed using a computer.

**Discussion**

The results of the experiment showed that the flow-through rate of the nano-silver suspension was significantly lower than the flow-through rate of the pure water column. This indicates that the presence of nano-silver particles in the sand column had a significant effect on the flow rate. The complex conductivity measurements were able to detect the presence of nano-silver particles in the sand column, providing valuable information for future studies.

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**Methods**

- **Preparation:** Three identical columns (made of PVC pipe) were used with 15 cm of clean quartz sand to which the nano-silver dispersion was added.
- **Injection:** The nano-silver dispersion was injected into the sand column at a flow rate of 12 ml/hr for 3 h. The pump was stopped every minute to allow the air bubble to rise and extract the nano-silver suspension. The air bubble was then replaced by the next sample and the process was repeated.

**Results**

- **Break Through Measurements:** The CC measurements were recorded at intervals of 30 min. The CC measurements were recorded at intervals of 30 min. The CC measurements were recorded at intervals of 30 min.

**Conclusions**

The results of the experiment showed that the flow-through rate of the nano-silver suspension was significantly lower than the flow-through rate of the pure water column. This indicates that the presence of nano-silver particles in the sand column had a significant effect on the flow rate. The complex conductivity measurements were able to detect the presence of nano-silver particles in the sand column, providing valuable information for future studies.