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Extended Abstracts

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Aquifer management

3.4
Environmental and artificial tracers in hydrogeology

title: **Experimental evaluation of selected tracers in different environmental conditions for tracing water resources**

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Tracing is one of the most precise and reliable methods in hydrogeology in which it is an important task to select a proper tracer. To achieve this aim, it is necessary to have enough knowledge of the physical and chemical behaviors of various tracers in different field conditions. In this research, effect of some factors such as pH, sunlight, temperature, adsorption onto porous media, salinity and chlorine on different tracers is evaluated and discussed in a chemical laboratory. Uranine, eosin and rhodamine B (fluorescent dye tracers), $KMnO_4$ (non fluorescent dye tracer) and NaCl and KCl (chemical tracers) have been selected for this study. Results of experiments show that uranine losses its florescence in acid environments, while in alkaline conditions its florescence increases (Figure 1, 2, 3). Table 1 show the results of change fluorescent tracer in different pH condition. Other tracers were stable in different pH. Results also show that because of photochemical decay, fluorescent decrease whit time (Figure 4, 5, 6). Eosin is the most unstable tracer if subjected to sun light (Figure 5). NaCl and KCl were stable on sun light in large time. $KMnO_4$ turns to brown under sun light.

Table 1. Effect of pH in fluorescent of some tracers.

Tracer	Acidic pH	Alkaline pH
Uranine	Very instance decrease in pH less than 6	Very instance increase in pH more than 8
Eosin	decrease in pH less than 4	no effect
Rhodamine B	decrease in pH less than 5	no effect

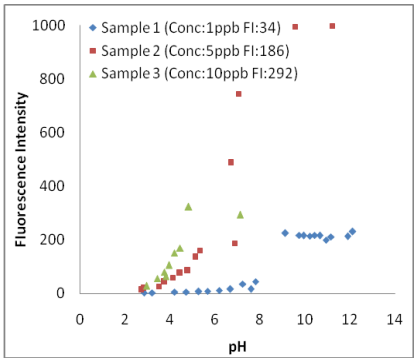

Figure 1. Effect of pH on uranine fluorescence.

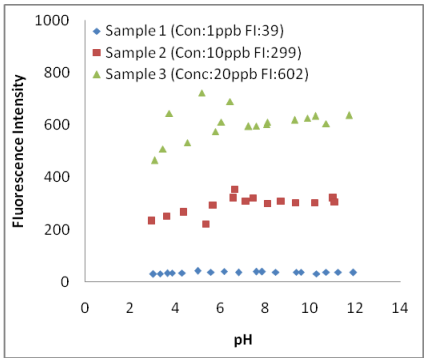

Figure 2. Effect of pH on eosin fluorescence.

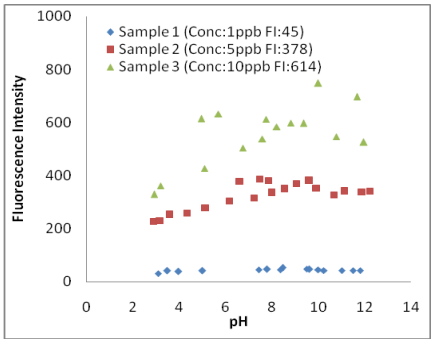

Figure 3. Effect of pH on rhodamineB fluorescence.

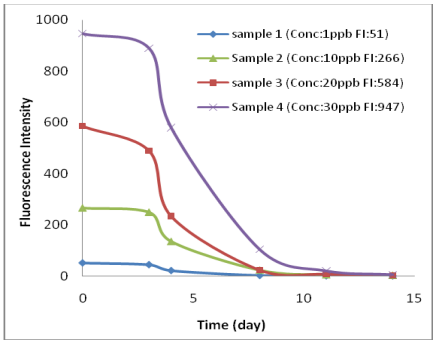

Figure 4. Photochemical decay of uranine.

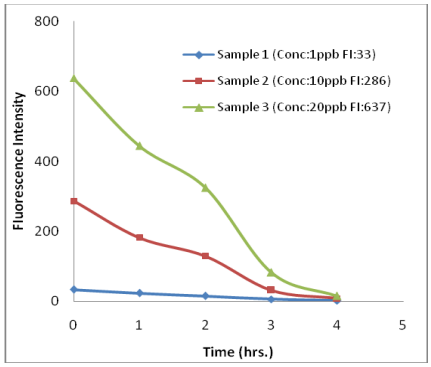

Figure 5. Effect of pH on eosin fluorescence

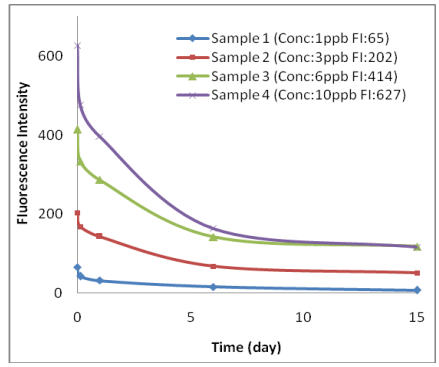

Figure 6. Photochemical decay of rhodamine B

Also, $KMnO_4$ turns to brown under higher temperature conditions and may lose its characteristics as a tracer. The fluorescence intensity of rhodamineB decreases with increasing temperature and NaCl and KCl induced salinity (Figure 7, 8). Uranine and eosin have high resistance against high temperature and salinity.

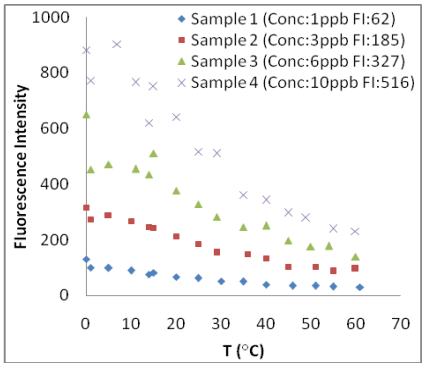

Figure 7. Effect of temperature on rhodamineB.

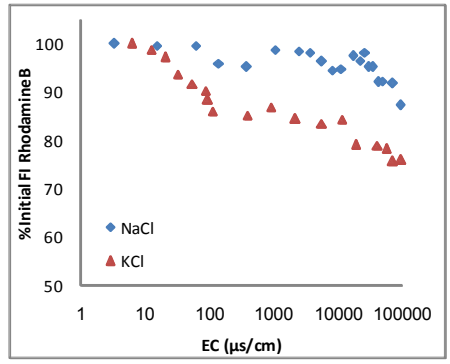

Figure 8. Effect of salinity on rhodamine B.

Absorption of tracer to the aquifer material is among the most important factors which should be considered when a tracing program is considered. With regards to adsorption in porous media, column method (Figure 9) that used and results show that rhodamine B and $KMnO_4$ would easily adsorb in fine grain porous media while uranine and eosin have high resistance against adsorption (Figure 10). Chlorine used in drinking water treatment is a strong oxidizer even in low concentrations and may lead to elimination of fluorescence of uranine, eosin and rhodamine B.

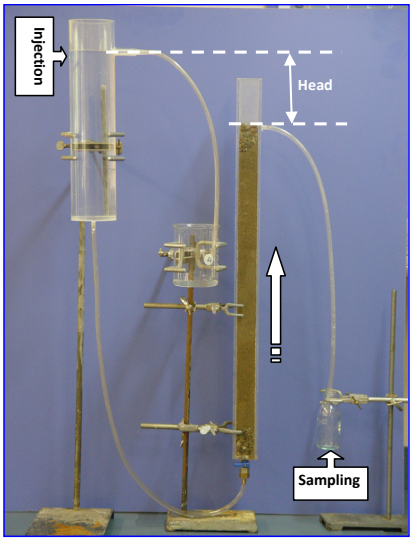

Figure 9. Absorption model whit column method.

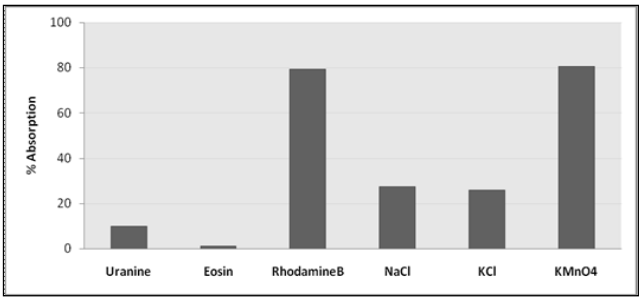

Figure 10. Compare presentage of tracer absorption in porous media.

On the result of this experiments we can consequence that at the tracing plan select a proper tracer whit consider hydrological conditions of aquifer, chemical compound of water is very important.

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