Report

07/12/05

1. **Experimental Progress:**

Last week we have filled up the reservoir with fresh DI water several times. We got a consistent pH of 6.3 ~ 6.4 but resistivity is still inconsistent and unstable (without using the venturi). Due to the circulating pump, water temperature is increasing and our cooling loop is not sufficient to stabilize the temperature. Truman S. Light et. al. describe the exponential relation between the resistivity and temperature. My hypothesis is that unstable temperature might be the reason of unstable resistivity. I am planning to perform some closed loop experiments (with APS water) to verify this. In my closed loop experiments I would verify the exponential relation between resistivity and temperature at a constant DO level.

[Ref: 1. Truman S. Light; Stuart L. Licht, "Conductivity and resistivity of water from the melting to critical points", *Analytical Chemistry,* 1987,59, 2327 – 2330]

2. Truman S. Light, "Temperature dependence and measurement of resistivity of pure water", *Analytical Chemistry,* 1984, 56, 1138 - 1142]

2. **pH Sensors:**

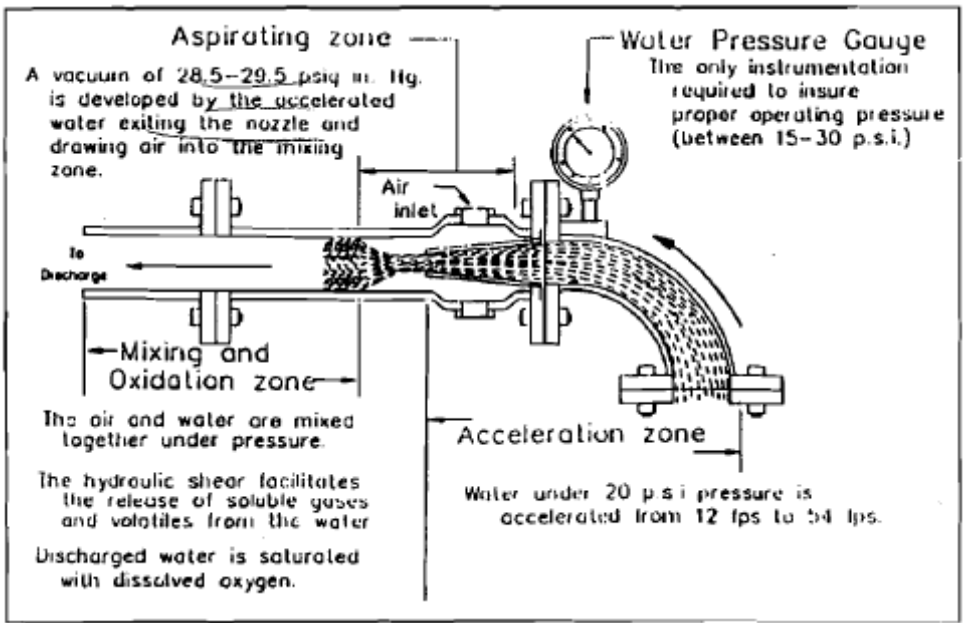
The pH sensor manual recommends continuous flow of DI water through the sensor. During the shutdown it should be stored in 3M Potassium Chloride solution. I have brought around 15gms of Potassium Chloride from IIT for the time being. Rich Ferry has ordered a bottle (500gms) of Potassium Chloride for our future use.

3. **Work Station at Tech Area:**

Currently we are installing a control valve for the water level of the reservoir. This would start the filling pump when the water level goes below a certain level.

4. **Working principal of venturi:**

The following picture portrays the mechanism of working principal of venturi.



A venturi can increase dissolved oxygen level of water to 12.5 ppm (according to John Salonich of Venturi Aeration). Simultaneously, it strips out partially soluble gases with weak Henry's constants (e.g. CO_2) by a hydraulic shear. (I will find out the exact values of Henry's constant of these gases).

[Ref: 1. Joseph E. O'Brien; Richard D. Fuller; John P. O'Hare, Hydro-vac treatment of septage for odor elimination and increased revenue, *J. of the new England water environment association*, November 1994

2. http://www.venturi-aeration.com/biorem.htm]

5. **Dissolved Oxygen and pH:**

Since, APS water does not contain any CO_2 and venturi does not draw any CO_2 in the system I am expecting oxygen is the only gas which will affect pH. The mechanism is as following:

Hydrogen dissociation reaction in equilibrium is:

$$2H_2O \leftrightarrow 4H^+ + O_2 + 4e^-$$

According to Le Chatelier's Principal, increase in oxygen or hydrogen ion concentration by any external means will increase the reverse reaction ($2H^+ + O \rightarrow H_2O$) rate to accommodate any additional O_2 / H^+ and to maintain the equilibrium. So, higher dissolved oxygen will increase the reverse reaction rate which will consume H^+ ion also. Reduction in H^+ will increase pH.

The effectiveness of the above process can be verified by our experiment.