Lab #2 HINTS   Winter 2005

Question 1: You will need to use the pooled data for this question in order to compare the results and discuss how the characteristics of the water changed through the treatment process.

There were four sewage samples:
- Raw (before any treatment)
- Primary (after primary settling)
- Mixed liquor (recycled organisms from secondary settling) and
- Secondary/Final (before leaving the treatment plant)

Each stage of the treatment plant should show a reduction in solids, oxygen demand, and bacteria (except for the mixed liquor, since it contains recycled organisms).

You should calculate a BOD_5 for each of sample types. This may involve averaging the pooled data or whatever you see most appropriate.

Calculate the number of bacteria cells based on the number of bacteria colonies on the plates. Be sure to account for the fact that the samples were diluted for the HPC and MF tests!

You should calculate the four values of solids:

- fixed dissolved
- volatile dissolved
- fixed suspended
- volatile suspended

Dissolved solids pass through the filter, suspended solids are caught on the filter.

Total = Dissolved + Suspended

See the notes for *Tutorials 2 and 3* for additional calculation hints.

Questions 2 and 3: These are discussion questions to get you thinking about BOD. You should calculate a BOD_{ult} based on your lab data and include it in your discussion.

Some background info to keep in mind:

BOD is the amount of oxygen required for bacteria to decompose organic matter in the solution. This is an indicator of how much organic matter is in the sample. It does not tell you how many organisms are present! It tells you how much oxygen is needed for decomposition of organic matter.

Reasons for the BOD test:

(1) to determine the approximate amount of oxygen to biologically stabilize the organic matter in a system,

(2) to determine the size of waste treatment facility

(3) to measure the efficiency of some treatment processes

(4) to determine compliance with wastewater discharge permits.

The BOD (sometimes called BOD_{ult} for ultimate BOD) may take a long period of time to reach (long decomposition time) - so a shorter time period is used.

In your lab, you are measuring BOD_5 (or BOD_4 or BOD_6 depending on your lab day) at two dilutions. **Note: if you are measuring BOD_4 or BOD_6, be sure to calculate BOD_5 in your lab report!**

Remarks:

- The dilution water was NOT seeded. There were enough organisms in the sample already. Therefore, use f=1.

- There are some <u>extra conditions for valid BOD tests</u>:
  - $D_2 > 1$ mg/L (if it is less than 1 mg/L, the bacteria did not have enough oxygen for the 5 days)
  - $D_1 - D_2 > 2$ mg/L (if it is less than 2 mg/L, the bacteria were not decomposing the organic matter properly)
  - $B_2 << B_1$ (the dissolved oxygen in the blank samples should not change very much)

Question 4: For this question you are only expected to give a general description of what kind of bacteria are present (think about the two types of tests carried out). Refer to course notes or course texts to determine what types of bacteria are *expected* in the water.

Many kinds of bacteria exist, some of which are hazardous (e.g. disease causing organisms). Since testing for each organism is time-consuming and expensive, we use indicator tests. With these tests, we can only be certain of the presence of indicator bacteria. The assumption in this lab is that each colony was formed from only ONE organism. (How good is this assumption?)

Question 5: In your lab, you performed a Heterotrophic Plate Count and a Membrane Filter Technique. The first measures *all bacteria*, the second measures *fecal coliforms only*.

Total Coliform = Fecal + Non Fecal

To compare the Heterotrophic Plate Count and Membrane Filter Technique results, be sure to *calculate the total number of cells in the original sample* (the plate counts give a measure of the dilution only).

Are the BOD and fecal coliform counts acceptable for release into a river? Compare them with the appropriate guidelines.

Question 6: A short discussion is required. You may use any appropriate references just be sure to list them.

Questions 7 and 8: Solids is also an indicative parameter. Solids indicate the strength of the wastewater. These are both discussion question to get you thinking about the significance of solids. You may use any appropriate references here also.