Factors Affecting the Toxicity of Wastewater

Although plants are a major component of wetland ecosystems, only one study used them in their impact assessment bioassay (Bendell-Young et al, 2000). The impact of toxins on plants can be measured as their growth and photosynthetic rates will be impacted when presented with stress (Bendell-Young et al, 2000).

Data Collected from Effluent Assays

As mentioned, the output collected from effluent assays will be the relative toxicity of the effluent of interest. But toxicity of these effluents can vary widely dependant on the receiving waters they pour into (Hendersen & Tarzwell, 1957). For this reason, both the effluent and the receiving waters should be tested and combined to see if there are any synergistic effects. Some of the factors that may affect toxicity of effluent are synergy, antagonism, temperature, carbon dioxide, pH, alkalinity, hardness and dissolved oxygen (Hendersen & Tarzwell, 1957). These factors will directly affect the LC50 values for the effluent of study.

The most important data to be collected from effluent bio-assays is the LC50 amounts. This is how you can determine how toxic the effluent is, or could be, on the target organisms. Below is a table I have recreated from Hendersen and Tarzwell (1957), which shows how your data could be tabulated following an acute toxicity bioassay.In this case, the LC50 would be at an effluent concentration between 3.2% and 5.6%, which could be determined using interpolation on a graph.

Bendell-Young et al (2000), performed their bioassays in a different fashion than a straight-forward acute effluent assay, and thus the data they acquired is fairly diverse. They found that in comparative pools, some being directly impacted with oil sands' effluent, and some being non-impacted, that impacted waters had lower diversity within their benthic communities (Bendell-Young et al, 2000). However, it was found that biomass was significantly higher in those wetlands that received oil sands' effluent, specifically for chironomids (Bendell-Young et al, 2000). When they tested for mutagenicity, they found that none of the chironomids from any of the pools sampled contained them (Bendell-Young et al, 2000). Their studies of cattails showed an elevated rate of photosynthesis in those wetlands with effluent runoff, although there was no difference in maximum leaf height (Bendell-Young et al, 2000). Fathead minnows that were taken from effluent wetlands and placed into control wetlands showed increased hematrocrit and leuococrit values, with some fathead minnows being placed in effluent wetlands that did not survive the 96 hr exposure period, and some that did not survive the 28 day exposure period (Bendell-Young et al, 2000).

Overall, this study of the Fort MacMurray oil sands wetlands ecosystems showed that these effluent wetlands were capable of supporting low-diversity, benthic communities, which are predominantly made up of Chironomidae (Bendell-Young et al, 2000). Cattails were able to grow successfully in these effluent waters, but the two fish studied (fathead minnows and brook sicklebacks) were not found to be able to be a functional part of these ecosystems, ultimately suggesting that these wetlands ecosystems would not be able to sustain biological life on higher trophic levels (Bendell-Young et al, 2000).