Reactor Characteristics

Introduction

Chemical, biological and physical processes in nature and in engineered systems usually take place in what we call "reactors." Reactors are defined by a real or imaginary boundary that physically confines the processes. Lakes, segments of a river, and settling tanks in treatment plants are examples of reactors. Most, but not all, reactors experience continuous flow (in and out). Sequencing batch reactors have a sequence of states including fill, react, and empty. It is important to know the mixing level and residence time in reactors, since they both affect the degree of process reaction that occurs while the fluid (usually water) and its components (often pollutants) pass through the reactor.

Chlorine contactor tanks are designed to maximize the contact time between chlorine and pathogens before the water is delivered to consumers. Thus the design objective is to maximize the time that it takes for water to travel from the tank influent to the effluent. Tracer studies can be used to determine the hydraulic characteristics of a reactor such as the disinfection contact tanks at water treatment plants. The results from tracer studies are used to obtain accurate estimates of the effective contact time. In this laboratory students will experiment with different reactor designs with the goal of maximizing the contact time.

Reactor Classifications

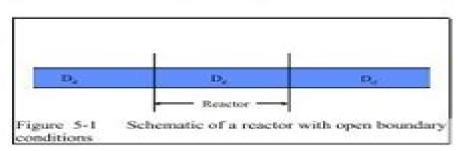
Dispersion

Mixing levels give rise to three categories of reactors; completely mixed flow (CMFR), plug flow (PFR) and flow with dispersion (FDR). The plug flow reactor is an idealized extreme not attainable in practice. All real reactors fall under the category of FDR or CMFR.

Boundary Conditions

The reactor inlet and outlet boundary conditions significantly affect the reactor response to the addition of a pulse of tracer. If dispersion is possible across a boundary,

then the boundary is open. An example of a reactor with оност. boundaries is a section of a river. If a tracer is added to a section of a river it is possible for some of the tracer to IIIDADAGE. upstream. illustrating that. arbitrary section of a river is an open reactor (Figure 5-1). This is equivalent to letting the reactor be



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