

## **WASTEWATER TREATMENT CENTER**

### **1. TECHNICAL DESCRIPTION, BACKGROUND**

A wastewater treatment center is built as part of a chemical factories waste management system. The factory produces certain products, for which the byproduct is highly acidic water. The company treats this water in a large tank, by mixing it with an alkaline chemical agent, which neutralizes the water. In order to be neutralized to an acceptable level, the water and the agent must sit in the tank a minimum of 20 minutes. In other words the reaction time is 20 minutes. After this the fluid is released into the sewage system.

### **2. PROBLEM**

The fluid at the outlet of the tank is checked, and it is seen that with a given steady flow rate, the acidity of the fluid is too great. The process therefore needs to be examined, and suggestions for the correction of the problem need to be made

### **3. PROCEDURE**

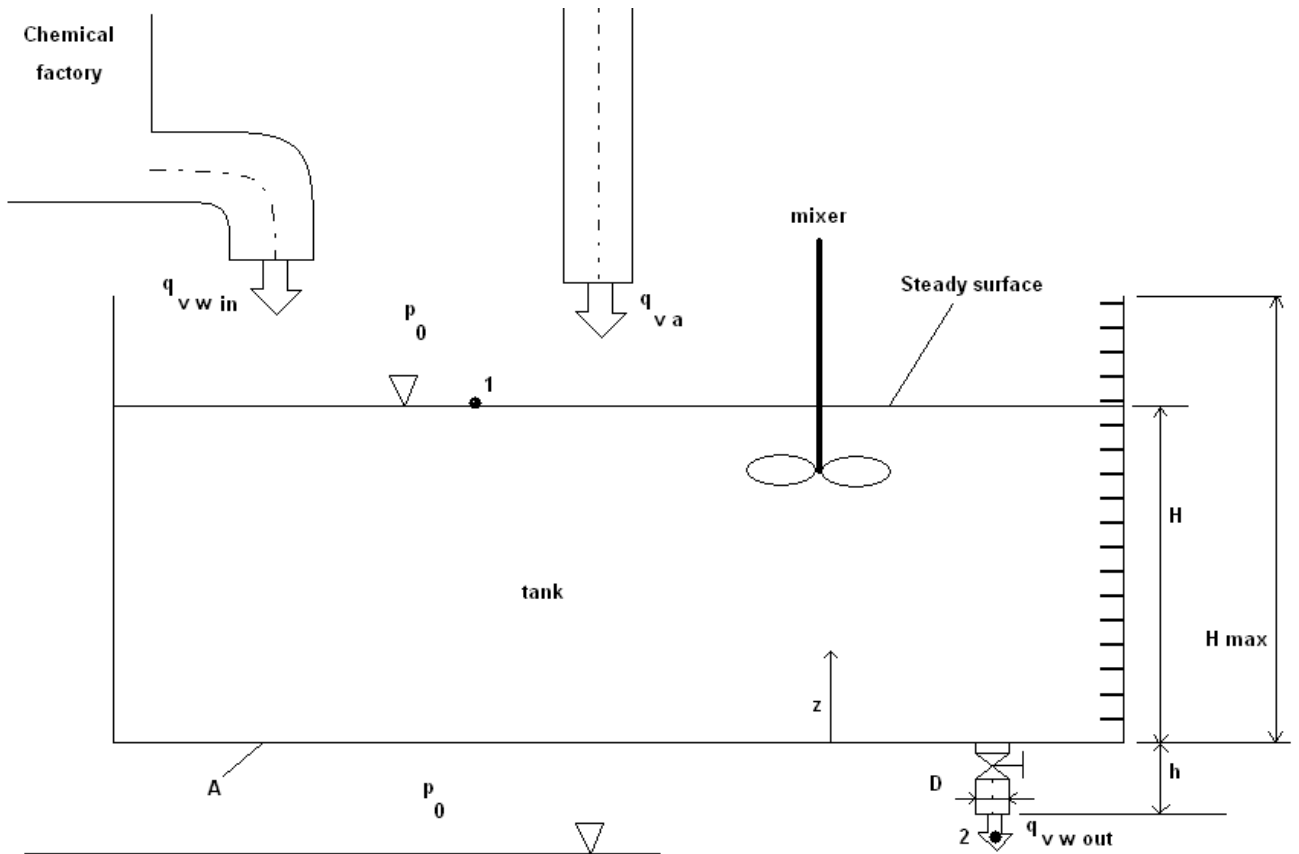
Why is the acidity of the fluid too great?

How can the different reasons for this be examined (measuring techniques, equations to be used for solving the problem, and the calculated results)?

What can be done in order to resolve the problem?

### **4. ENGINEERING CALCULATIONS**

Give suggestions for resolving the problem, and calculate the case, where the  $t$  is considered too small from the given data ( $t < t_{cr}$ ).



**Figure 1.**

Geometric Data:

$$\text{Area of tank } A = 10[m] \times 20[m] = 200[m^2]$$

$$\text{Height } H = 2.5[m]$$

$$\text{Maximum Height } H_{\max} = 5[m]$$

$$\text{Height of outlet pipe } h = 0.5[m]$$

$$\text{Diameter of outlet pipe } D = 0.3[m]$$

Present Processes Data:

$$\text{Alkaline Agent Flow Rate } q_{va} = 2 \left[ \frac{m^3}{h} \right]$$

$$\text{Residence time to be guaranteed for the reaction } t_{r,crit} = 20[\text{min}]$$

Tips:

What is the outlet flow rate?