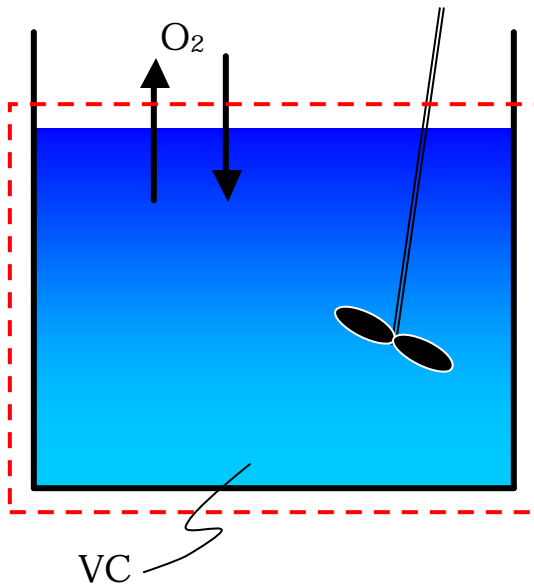


## GAS TRANSFER FROM AN AIR-LIQUID INTERFACE

CI 31A – MECÁNICA DE FLUIDOS  
 Prof. John Gulliver

### APPLICATION OF THE PRINCIPLE OF CONSERVATION OF MATTER



#### Accumulation = Flux In – Flux Out

We will consider the dissolved oxygen in the tank as the substance to be conserved.

First assumption: Well mixed tank.

Calling  $C$  ( $\text{gr}/\text{m}^3$ ) the concentration of oxygen in the water, the amount of oxygen in the tank is:  $M = VC$  ( $\text{gr}$ ), where  $V$  is the volume of water.

The flux of  $\text{O}_2$  is given by  $F = K_L A(C^* - C)$

Where  $K_L$  is the mass transfer coefficient ( $\text{m}/\text{s}$ ),  $C^*$  is the equilibrium concentration when there is no net flux with the air, and  $A$  is the

interfacial area.

Second assumption:  $C^*$  is a constant value.

Now assign  $\hat{C} = C^* - C$

$$\frac{d\hat{C}}{dt} = -\frac{dC}{dt}$$

let  $a = \frac{A}{V}$  a specific area:

$$\frac{d\hat{C}}{dt} = -K_L a \hat{C}$$

or

$$\frac{d\hat{C}}{\hat{C}} = -K_L a dt$$

Integrate from  $t = 0 \rightarrow t$  and  $C = (C^* - C_0) \rightarrow (C^* - C)$ :

$$\ln(\hat{C})_{C^*-C_0}^{C^*-C} = -K_L at \Big|_0^t$$

$$\ln\left(\frac{C^* - C}{C^* - C_0}\right) = -K_L at$$

or

$$C^* - C = (C^* - C_0) \exp(-K_L at)$$

$$C = C^* + (C_0 - C^*) \exp(-K_L at)$$

$$C = C^* + (C_0 - C^*) \exp(-K_L at)$$