

EXPERIMENT No. 6

Study of Absorption of Carbon dioxide in an Agitated Contactor

Objective:

- (1) To find out the mass transfer co-efficient $K_L a$ for absorption of carbon dioxide in water in an agitated contactor.
- (2) To observe the effect of speed of agitator on $K_L a$

Theory:

The absorption rate of carbon dioxide in a agitated tank can be given as

$$V \frac{dC_L}{dt} = K_L a (C^* - C_L)$$

Where, V = volume of liquid, cm^3
 C_L = concentration of carbon dioxide in the liquid at time t , gmol/cm^3
 C^* = solubility of carbon dioxide in pure water at the temperature of the Experiments

On integration of the above equation at $t=0$, $C_L=0$ and at $t=t$, $C_L = C_L$ and rearranging,

$$K_L a = \frac{V}{t} \ln \left[\frac{C^*}{C^* - C_L} \right] \text{ in cm}^3/\text{min if } t \text{ in min}$$

$C^* = 3.3639 \times 10^{-5} \text{ gmol}/\text{cm}^3$ at 25°C at 1 atm

Apparatus:

- (1) One baffled reaction vessel fitted with agitator and gas-purging tube.
- (2) Tachometer
- (3) CO_2 Cylinder and Air compressor
- (4) Stopwatch

Chemicals:

- (1) N/20 $\text{Ba}(\text{OH})_2$ Solution
- (2) N/50 Succinic Acid Solution
- (3) Phenolphthalein indicator

Procedure:

- (1) Rotameters for CO_2 and air are first calibrated.
- (2) At a constant stirrer speed and temperature, CO_2 is absorbed in one liter of water in the agitated contactor for a definite period of time (less than 3 min). The concentration of CO_2 should not be more than 15%. The solution is collected and analyzed by titration.
- (3) Repeated the experiment for three RPM.
- (4) Calculate $K_L a$ for these different RPMs and show the plot.

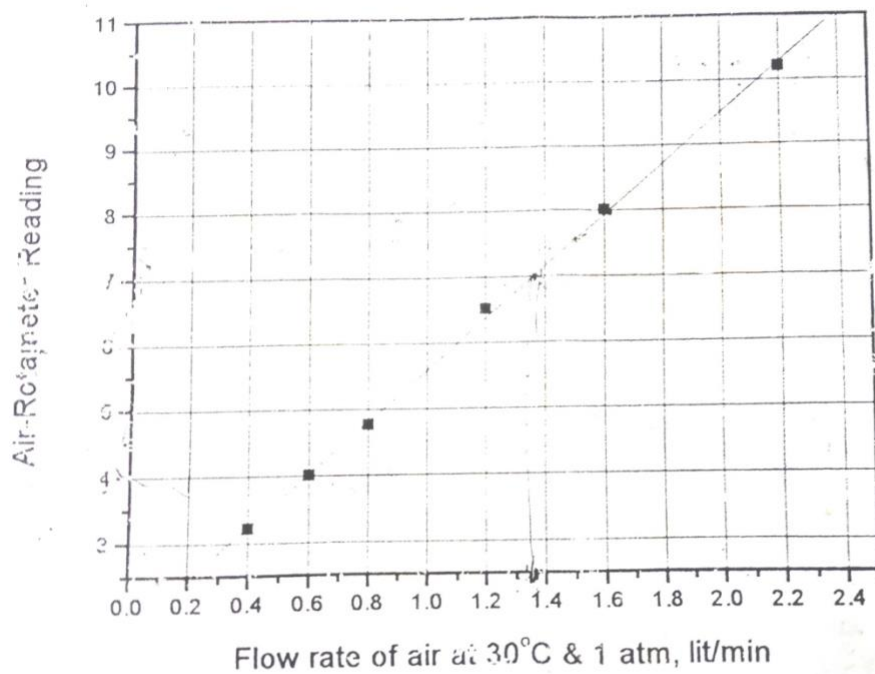


Fig.1 Calibration of air-rotameter

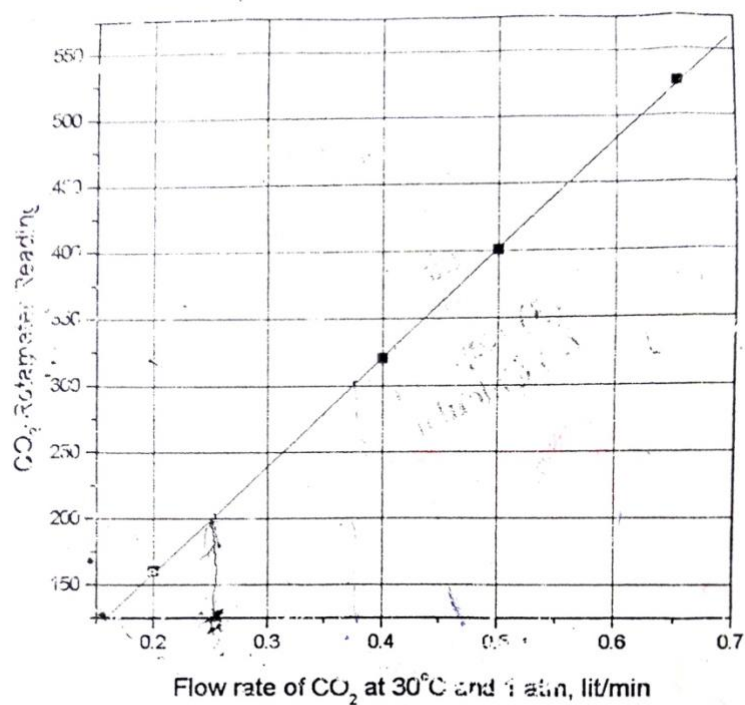


Fig.2 Calibration of CO₂ -rotameter