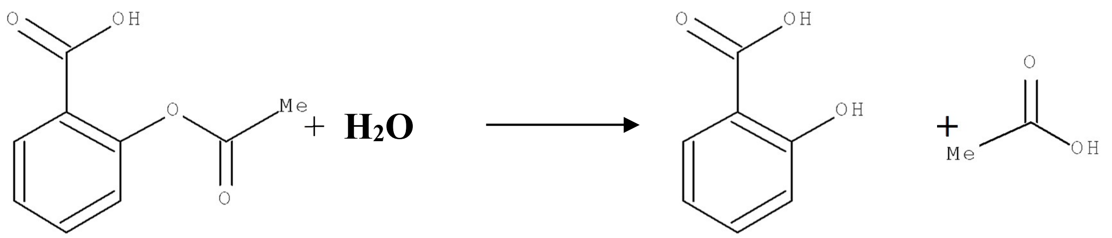
# Lab. 4: Stability of Aspirin (Storage Test)

Expire of any drug means that 10% of drug concentration is decomposed at room temperature. Pharmaceutical decomposition can be classified to hydrolysis, oxidation, isomerization, and photolysis, and these processes may affect the stability of drug in liquid, solid, and semisolid.

Aspirin mostly decomposed by hydrolysis, reaction with water. It is stable in dry air, but in the presence of moisture, it slowly hydrolyzes into acetic acid and salicylic acid.




Hydrolysis of aspirin is first order kinetic, where rate of reaction depends on concentration of aspirin. As in the first order reaction law:

$$\log C = \log C_O - \frac{kt}{2.303} \qquad \ldots\ldots(10)$$

where, $C_o$ initial concentration.

$C$ remaining concentration

$k$ first order rate constant (time$^{-1}$)

$t$ time

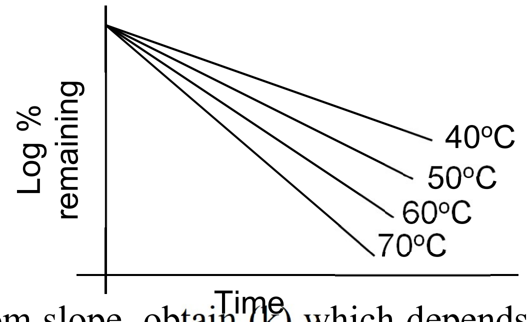
In many pharmaceutical-manufacturing companies, in order to determine the hydrolysis of aspirin, used elevated temperature to accelerate the hydrolysis, then decrease the time required for hydrolysis.

By using equation (10), we can plot log percent of drug remaining against time at different temperature.

$$\text{Aspirin remaining } \% = \frac{2x - y}{x} * 100$$

x = $V_{mL}$ of NaOH initial at t=zero.

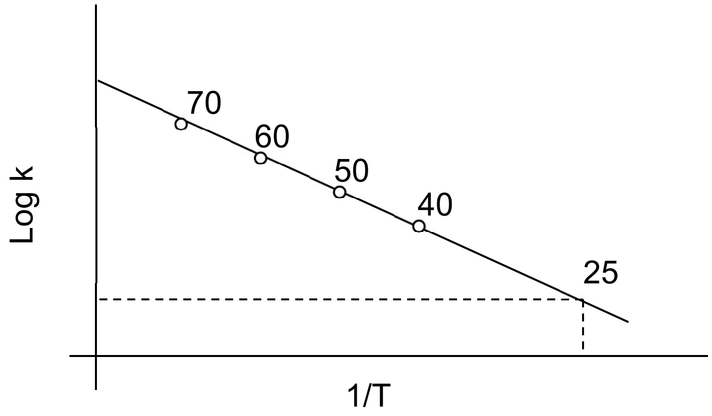
y = $V_{mL}$ of NaOH at t=t




From slope, obtain (k) which depends on temperature only. Slope = -k/2.303

From graph above, we obtained different values of (k) from slopes for certain temperature. Plot log k versus 1/T by Arrhenous equation to determine k value at 25°C.

$$\log K = \log A - \frac{E_a}{2.303R}\frac{1}{T} \quad \text{.........} (11)$$




Determine log k at 25°C (room temperature) and use $k_{25}$ to calculate $t_{90}$ by equation:

Half time $t_{0.5} = \frac{0.693}{K_{25}}$ ....(12) Shelf life $t_{90} = \frac{0.105}{K_{25}}$ ......(13)

**Procedure:**

1- Prepare aspirin solution (4.5g aspirin and 13.5g trisodium citrate) in 250mL D. W.
2- Take 10mL of solution and titrate against (0.1N) NaOH, using ph. ph. as an indicator. Where, $V_{mL} = x$, at initial time.
3- Portion 240mL of solution into three flasks; put each flask at certain temperature, 50, 60, and 80°C, using water bath.
4- From each flask, withdraw 10mL of solution and titrate against NaOH at different time, as in table below.
5- Use the table below to record the results:

**Table (4)**

x = $V_{mL}$ of NaOH at initial time (t=0).

| **Time (min)** | **$V_{mL}$ at 50°C** | **$V_{mL}$ at 60°C** | **$V_{mL}$ at 80°C** |
|---|---|---|---|
| 10 | | | |
| 20 | | | |
| 30 | | | |
| 40 | | | |
| 50 | | | |