RESULTS AND DISCUSSION

SECTION(A)
STUDYING THE CORROSION BEHAVIOR OF 316L SS
BY THE CHEMICAL TECHNIQUS

To evaluate the influence of p-aminoazobenzene compounds on the corrosion of 316L SS in 3M hydrochloric acid, the weight-loss technique was employed as the chemical testing technique.

3.1-CORROSION INHIBITION BEHAVIOR

The corrosion behavior of a metal in an aqueous environment is characterized by the extent to which it dissolves in the solution. This can be quantified by using the simple relationship as before (equation 2.1)

The degree of dissolution, of course, dependent on the surface area of the metal exposed and the time of exposure; hence the amount of corrosion is given with respect to area and time.

$$\text{Corrosion rate} = \frac{\Delta W}{a \, t} \qquad (3.1)$$

where:

ΔW :is the weight loss.

a :is the area of electrode in cm^2.

t :is the time immersion in min.

The resulting quantity, corrosion rate, is thus a fundamental measurement in corrosion science. Corrosion rates can be evaluated by measuring either the concentration of the dissolved metal in solution by chemical analysis or by measuring weight of a specimen before and after exposure and applying equation (3.1). The later is most common method. The weight-loss method is usually preferred because the quantity measured is directly related to the extent of corrosion and does not rely on any assumptions about reactions occurring during corrosion.

Figures (3.1-3.4) show the weight loss-time curves for 316L SS in 3M hydrochloric acid in absence and presence of different concentrations of p-aminoazobenzene compounds. As shown in these Figs, by increasing the concentration of these compounds, the weight loss of 316L SS samples are decreased. This means that the presence of these compounds retard the corrosion of 316L SS in 3M hydrochloric acid or in other words, these compounds act as an inhibitors.

The linear variation of weight loss with time in uninhibited and inhibited 3M HCl indicates the absence of insoluble surface films during corrosion. In the absence of any surface films, the inhibitors are first adsorbed on to the metal surface and thereafter impede corrosion either by merely blocking the reaction sites (anodic and cathodic) or by altering the mechanism of the anodic and cathodic partial processes.

The percentage inhibition efficiencies (%IE) of p-aminoazobenzene compounds were determined by using the equation:

$$\%IE = \left(1 - \frac{W_{inh}}{W_{free}} \right) \times 100 \qquad (3.2)$$

where:

W_{inh} :is the weight loss of the metal in presence of inhibitor.
W_{free} :is the weight loss of the metal in absence of inhibitor.
and the surface coverage (θ) can be calculated from the following equation

$$\theta = I.E \qquad (3.3)$$

From the calculated values of %IE given in Table (3.1) which are represented graphically in Fig.(3.5), the order of the inhibition efficiencies of p-aminoazobenzene compounds is as follow:

$$III > II > I > IV$$

It is obvious from Fig. (3.5) that the inhibition efficiency of p-aminoazobenzene compounds increases with increasing the concentration of these compounds.
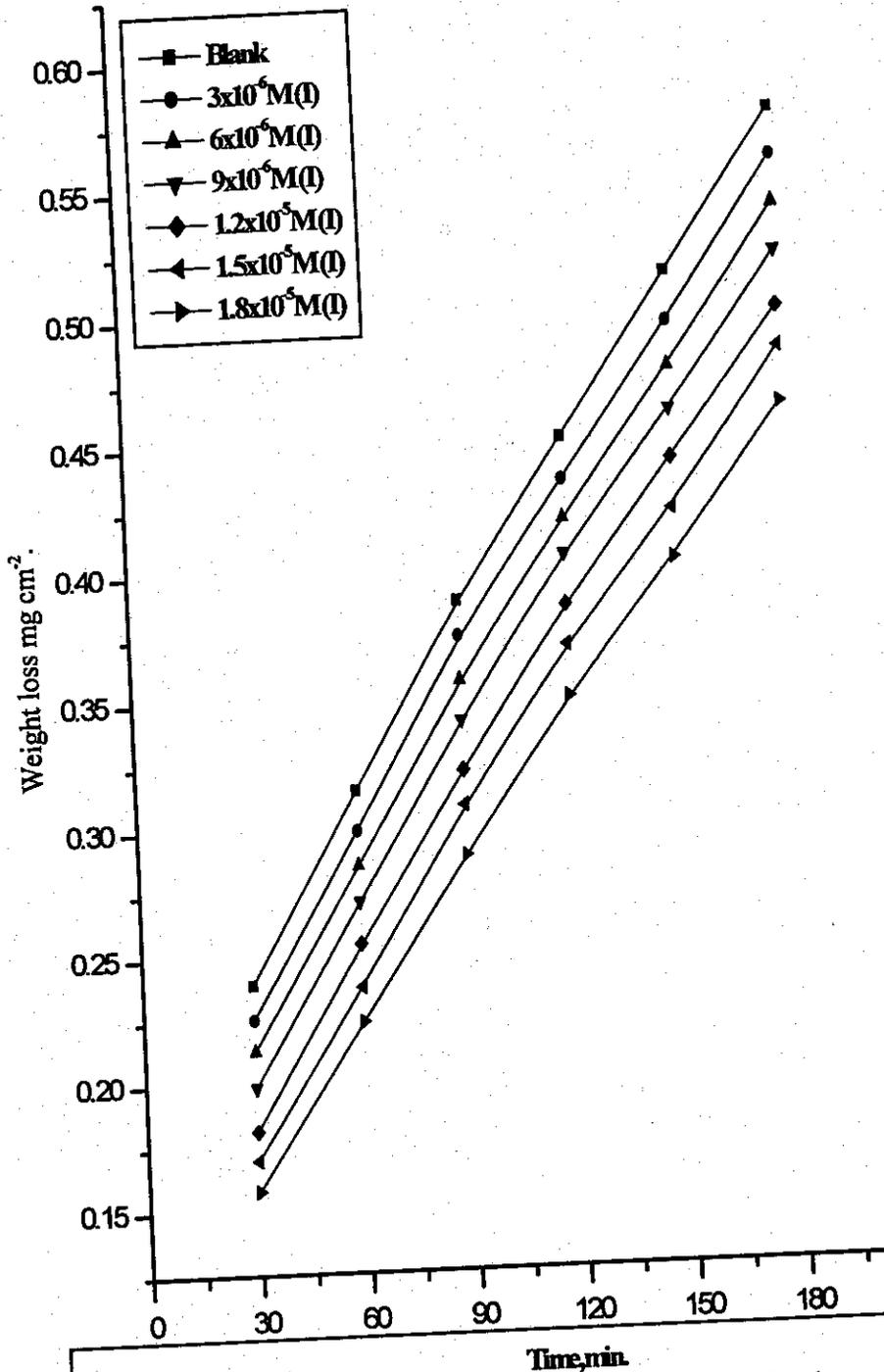
Fig.(3.1):Weight loss - time curves for the dissolution of 316LSS in abscence and presence of different concentrations of compound (I) at $30^{o}C$.
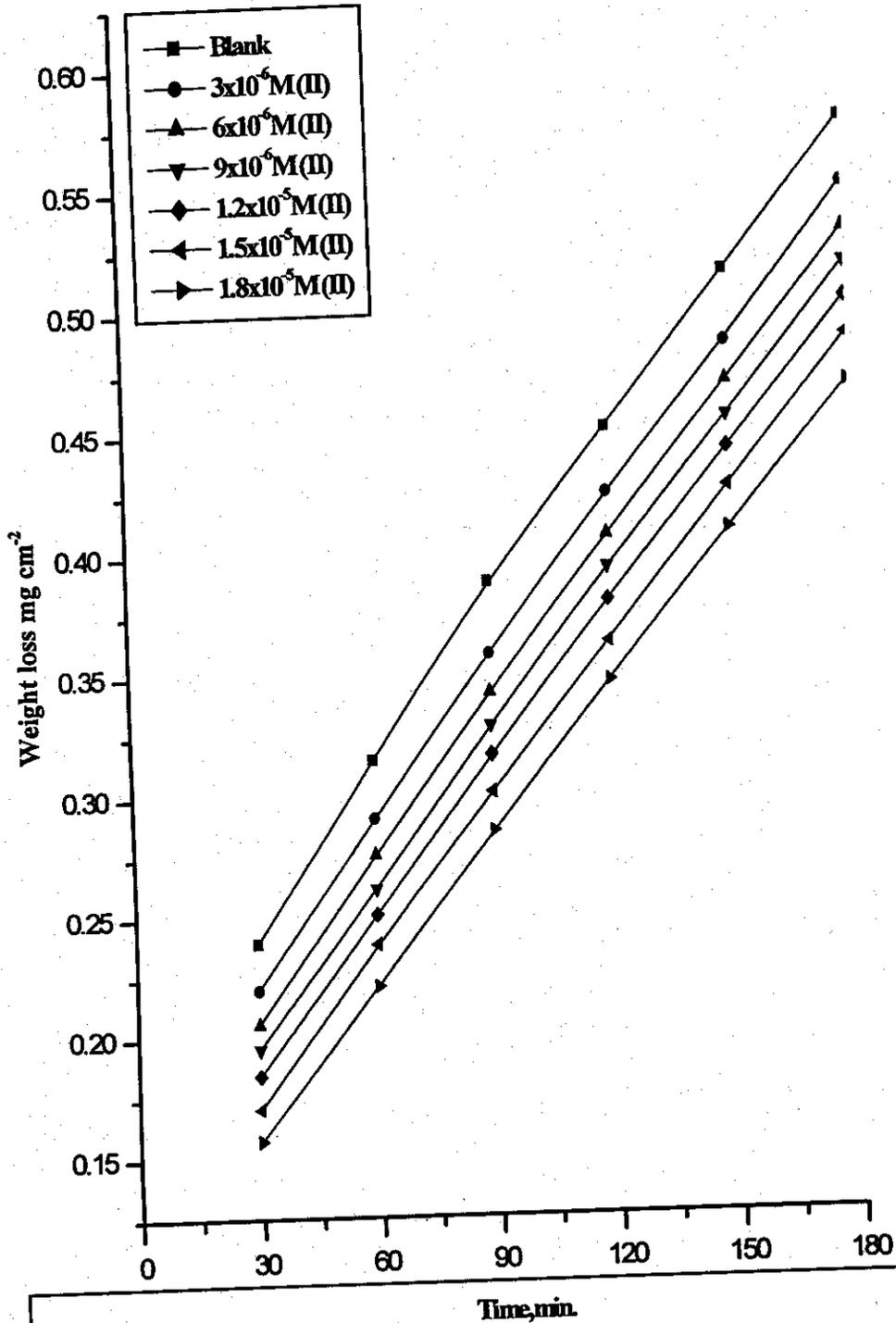
Fig.(3.2):Weight loss - time curves for the dissolution of 316L SS in abscence and presence of different concentrations of compound (II)at 30°C.
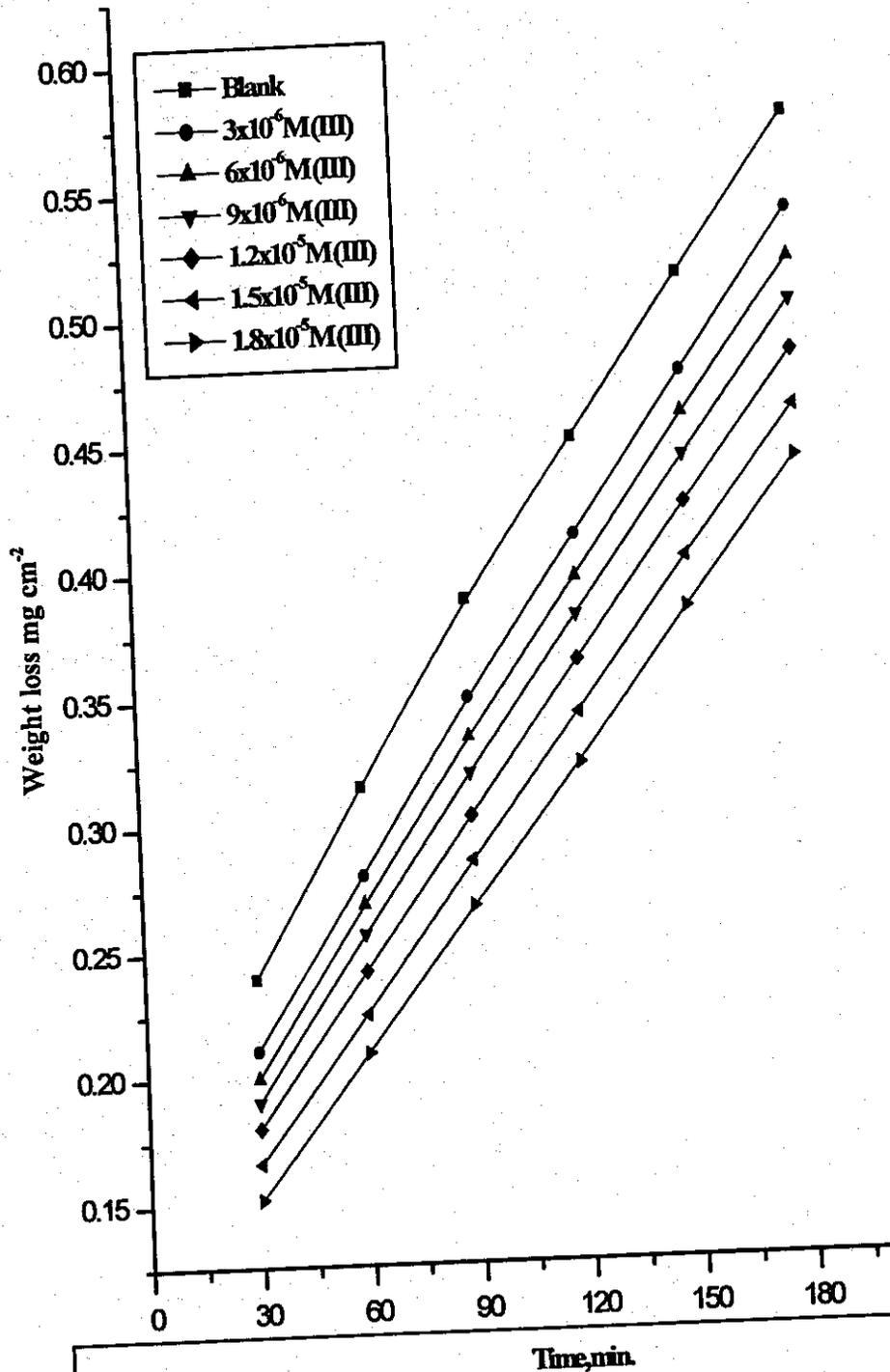
Fig.(3.3): Weight loss - time curves for the dissolution of 316L SS in abscence and presence of different concentrations of compound (III) at 30°C.
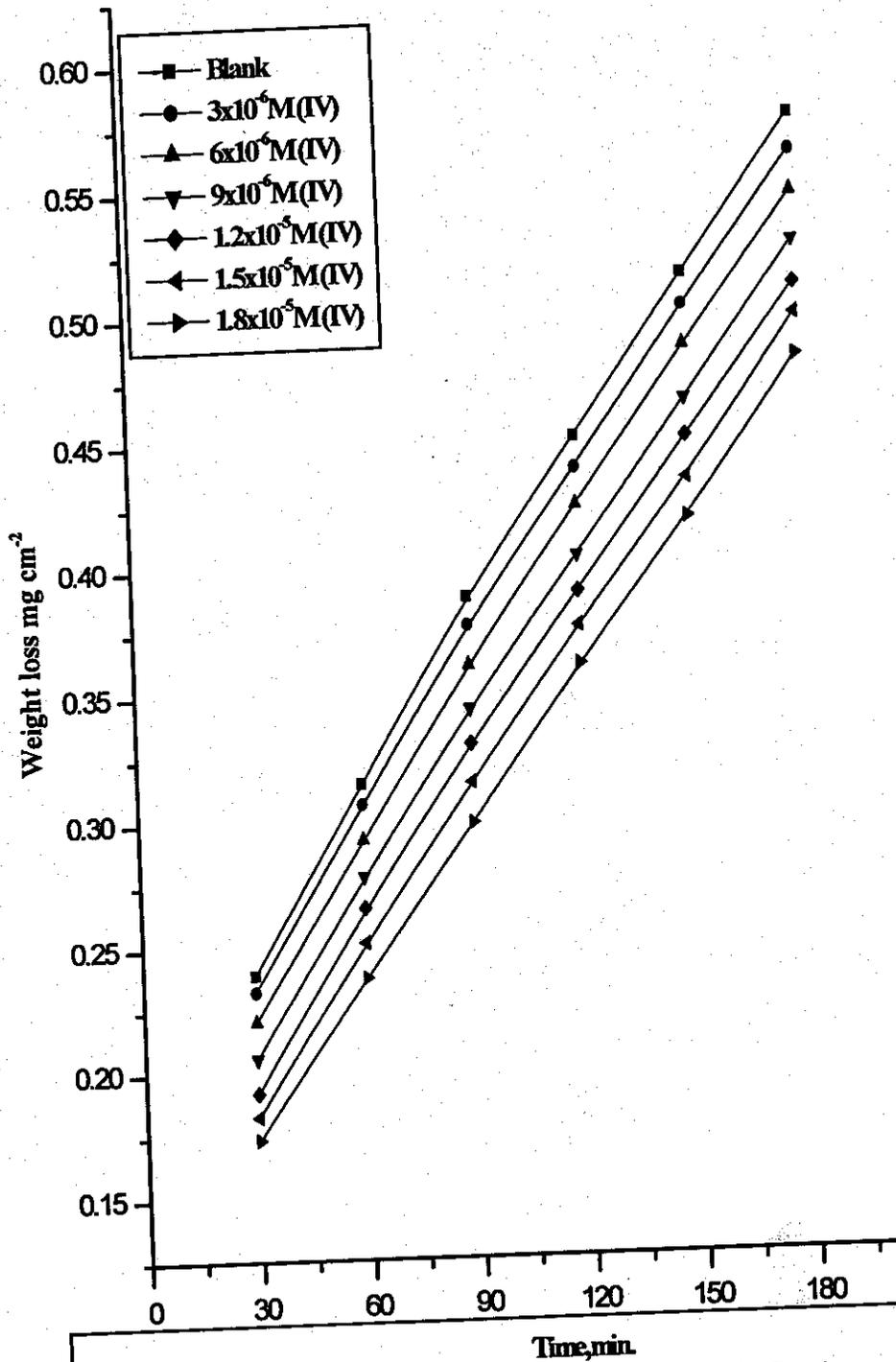
Fig.(3.4):Weight loss - time curves for the dissolution of 316L SS in abscence and presence of different concentrations of compound (IV)at 30°C.
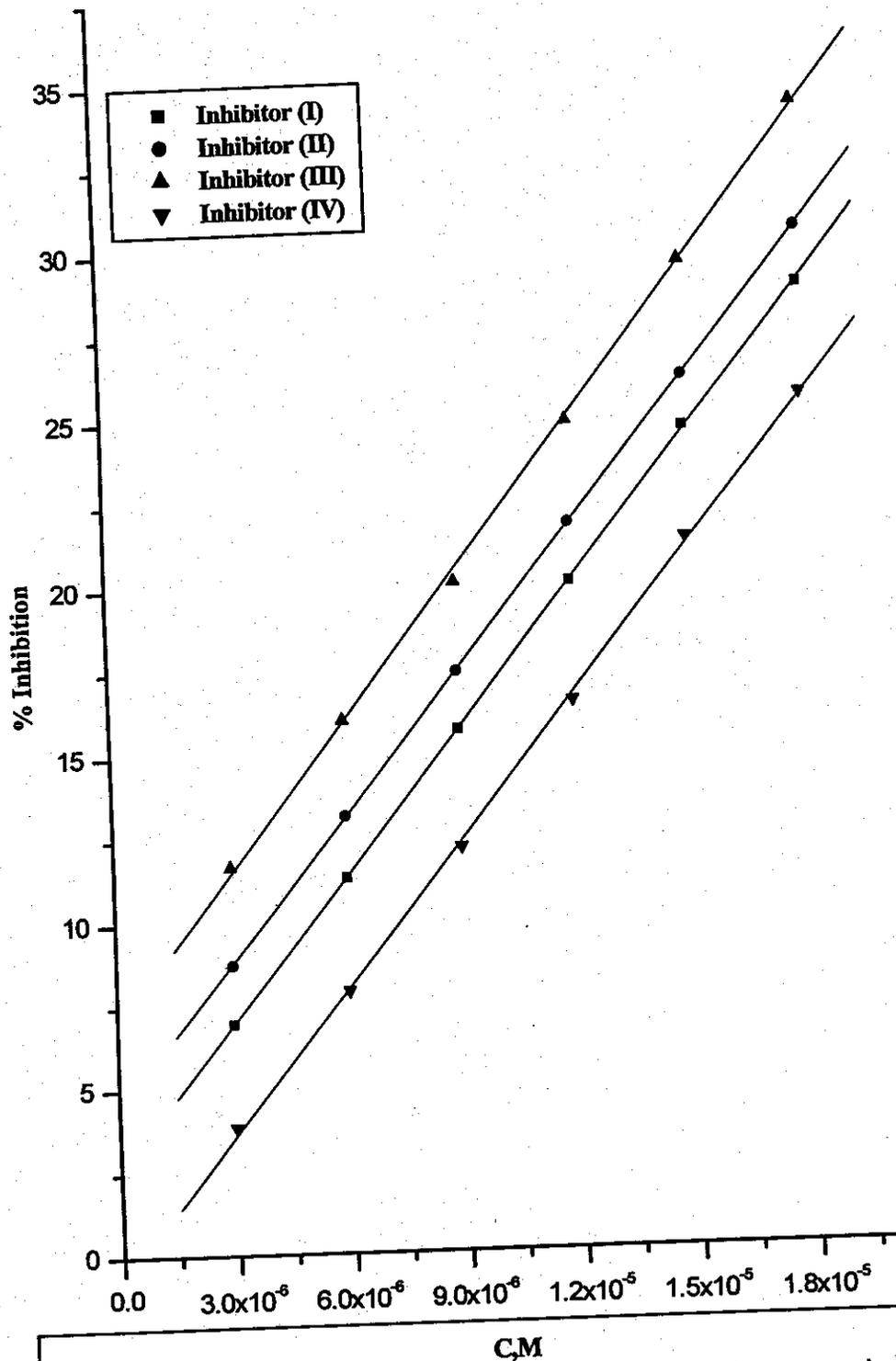
Fig. (3.5): Variation of the protection efficiency (%IE) with the concentration of inhibitors of 316L SS in 3M HCl at 30°C