The corrosion of metals and alloys has become a big problem not only for developing countries but also for developed countries. The management of corrosion losses is a task of great effort and utmost attention because it is associated with the money investment as well as with human lives. There are several methods that were adopted by people to inhibit the corrosion of metals and alloys. The application of inhibitors is one of them. This method has been surprisingly promoted due to its simplicity and effectiveness; however, some problems were detected with the frequent use of synthetic inhibitors, such as, high cost and toxicity. These issues have been eliminated by using green corrosion inhibitors. These inhibitors are either natural organic products or prepared from natural products. We have also used three natural organic products, Argemone Mexicana, Chlorophytum Borivilianum and Musa Paradisica, for corrosion inhibition studies. We found interesting results from our investigation as expected earlier. The results are summarized in the relevant sections of this chapter.

Argemone Mexicana, Papaveraceae family, performed as an efficient corrosion inhibitor in HCl and H_2SO_4 solutions. Weight loss measurements revealed that inhibition efficiency increased with the increase in the extract concentration in both acid media. A maximum inhibition efficiency of 92.5% and 86% was acknowledged in HCl and H_2SO_4. Adsorption of the extract molecules on mild steel was also investigated from weight loss data by using various isotherm models; however, we found best fitting results for Langmuir isotherms in both acid media. Furthermore, Tafel polarization study showed that addition of inhibitor shifted the corrosion potential of mild steel as well as lowered corrosion current with increase in the extract concentration. From the pattern of displacement in corrosion potential indicated that the Argemone Mexicana extract was a

mixed type inhibitor. The reason of corrosion inhibition could be stated as successful adsorption of the extract molecules on active sites on metal surface, which created an isolative layer at metal-acid interface and protected the metal. SEM and AFM study also confirmed the adsorption effect of the extract molecules.

Chlorophytum Borivilianum, Liliaceae family, provided efficient corrosion protection to mild steel in both acid media. From weight loss method results it was found that inhibition efficiency of the extract varied with the concentration of inhibitor. A maximum inhibition efficiency of 90% and 83% was achieved in hydrochloric acid and sulfuric acid solutions. Furthermore, interactions of metal and inhibitor molecules were investigated by various adsorption isotherms; however, Langmuir isotherm provided best fitting results in both acid solutions. The electrochemical tests revealed that the extract acted as a mixed type inhibitor in acid solutions and inhibited mild steel by forming a protective layer at metal acid interface. This fact was well supported by SEM and AFM images.

M. Paradisica, Musaceae family, is a cheapest source of effective organic molecules. Banana peels acted as efficient corrosion inhibitors. From weight loss measurements it was revealed that inhibition efficiency of the extracts increased with the inhibitor concentration but decreased with the ripening of the peels. The inhibition efficiency followed the order- Raw> Ripe> Over Ripe. The metal-inhibitor interaction was studied by various adsorption isotherm models, which suggested that Langmuir isotherm was the best candidate to explain adsorption process of inhibitor molecules on metal surface. The electrochemical measurements showed that all banana peel extracts worked as a mixed type inhibitor in HCl and H_2SO_4 solutions. The charge transfer resistance values at metal-acid interface increased with the inhibitor concentration, which diminished the effect of

acid solution on mild steel. Adsorption of the extracts molecules over mild steel surface could be accounted for the efficient corrosion inhibition, which was also supported by SEM and AFM study.

After careful analysis of the results, I would like to recommend banana peel extracts for the purpose of corrosion inhibition of mild steel inn acid media. To support my statement, a comparative description of the studied extracts is shown in Table 17. In context of cost, efficiency, effective concentration, availability and utilization value I find banana peels better than other studied extracts.

Table 6.1 A comparison of the inhibitive effects of studied extracts

Parameters	**Argemone Mexicana (AM)**	**Chlorophytum Borivilianum (CB)**	**M. Paradisica (MP)**
Cost	Cheaper	Cheap	Cheapest
Inhibition efficiency HCl H_2SO_4	 92.5% 86%	 90% 83%	 92% 86%
Effective concentration	500 mg L^{-1}	500 mg L^{-1}	300 mg L^{-1}
Utilization Value	Better	Good	Best
Thermal Stability	Highest	Higher	High
Environmental Stability	Excellent	Good	Very good
Availability	Easier	Easy	Easiest
Inhibition Mechanism	Mixed Type	Mixed Type	Mixed Type

6.1 Suggestions for Future Works

Argemone Mexicana, Chlorophytum Borivilianum and Musa Paradisica show great potential for corrosion inhibition of mild steel in acid media. However, their effectiveness can be further increased in future by following some suggestions.

1. The chemical constituents of the extracts should be separated for achieving better inhibition efficiency. In addition, the effect of active compounds of the extracts should be studied, separately.

2. For better thermal and environmental stability, the composites of extract compounds and polymers can be prepared. However, this is possible only if the compounds are separated from the extracts.

3. The extracts can also be used with organic coating materials, like paints, for corrosion inhibition.

4. The extract molecules can be encapsulated by some materials that allow slow diffusion of the molecules in working environments. Due to this, greater inhibition efficiency can be achieved for a longer period.

5. The different parts of the plants, which are not used frequently, can be investigated for corrosion inhibition study. It will give a wide range of data about inhibitive properties of a plant.