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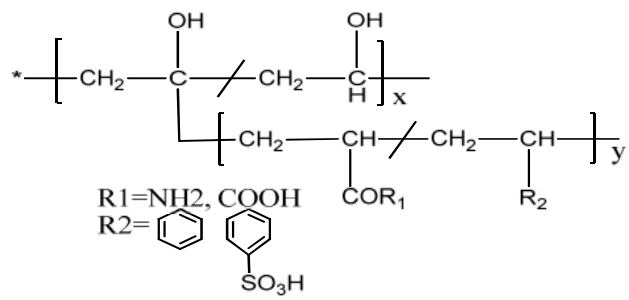
SUMMARY AND CONCLUSION

Corrosion control of mild steel in 1 M HCl by some synthesized water soluble terpolymer inhibitors was studied. A preliminary investigation on the applicability of the synthesized terpolymers on N80 steel in various harsh environments was also conducted. The outcomes of the present investigation can be briefed as follows:

- The synthesis of the grafted terpolymers was achieved with a yield in the range of 80-90 %.
- The spectral characterization of the grafted terpolymers aided in proposing the possible structure of the terpolymer given below:



- The thermal stability of the grafted terpolymers were smaller than that of ungrafted PVA, indicating the successful grafting.
- The melting point and glass transition temperature of the grafted terpolymers recorded using differential scanning calorimetric analysis were higher than the PVA polymer indicating the efficient grafting.
- The inhibition efficiency (IE %) of the grafted terpolymers, calculated from the weight loss technique increases with increase in concentration and time denoting that the effective surface coverage is influenced by both concentration and time. All the inhibitors furnished maximum IE % in the range of 90-96 % at 12 hours of immersion.
- The IE % of the grafted terpolymers increased with increasing temperature from 303 K to 333 K, and slightly decreased at 343 K. The increased IE % with temperature may be due to the uncoiling of the polymer chains leading to effective adsorption of the functional groups on mild steel surface. When the temperature increased some portions of the terpolymers could have hydrolyzed and desorbed resulting in decreased IE %. All the inhibitors furnished maximum IE % of 80-85 % in the studied temperature range.

- In potentiodynamic polarization measurements, the Tafel curves in the presence of grafted terpolymers are parallel to the blank Tafel curve suggesting activation controlled mechanism. The decreased Tafel slopes and negligible E_{corr} shift (less than 85 mV) with inhibitor addition, indicates mixed type inhibition of the grafted terpolymer. The corrosion current I_{corr} decreased with increase in concentration thereby rendering maximum IE(I_{corr}) % at 0.45 wt.% of the terpolymer.
- In impedance measurements, the Nyquist plot obtained was single capacitive semicircle with the center depressed under the real axis, as a result of surface inhomogeneties. The charge transfer resistance/ diameter of the semicircle increased with increase in inhibitor concentration and decreased with high temperatures. The IE calculated from charge transfer resistance (R_{ct}) increased with increase in concentration. The IE(R_{ct}) increased with increasing temperature from 303 K-323 K and then decreased.
- Basic information that deals with the interaction between inhibitor molecules and metal surface is analysed using adsorption isotherm. The surface coverage values calculated from weight loss, R_{ct} and I_{corr} of all the polymers were found to fit well in Temkin isotherm model. The higher equilibrium constant values determined in presence of terpolymers is an added proof that demonstrates their ability of enhanced adsorption on the MS surface. The $\mathbf{\Delta G_{ads}}$ values were negative and in the range of 40-80 kJ mol^{-1} confirming the chemical mode of adsorption of all the inhibitors. Similarly, the values of **ΔH** and **ΔS** also confirm the chemical mode of adsorption and orderly arrangement of inhibitor molecules. The adsorbed layer of the inhibitor molecules were confirmed through SEM and AFM images.
- The grafted terpolymers were tested for its efficacy to control N80 steel corrosion in 10 % HCl, 3.5 % NaCl and simulated well water. The inhibitors were tested by potentiodynamic and impedance techniques. The inhibitors were also tested in static and dynamic conditions at 55±5°C, for 6 hours immersion period by weight loss method. Among the five terpolymers investigated, acrylamide terpolymers were found to be effective in controlling the corrosion of different mediums. The potentiodynamic polarization study shown that the corrosion currents were minimized by the addition of inhibitor. The IE was well pronounced in simulated oil well water followed by HCl and 3.5% NaCl. The inhibitors action persistency analyzed by static and dynamic weight loss method shows that the inhibitor action is persistent in dynamic conditions. Hence the inhibitors can be optimized and recommended for usage in oil wells containing sour corrosion problems.