The Langmuir equation gives for non-dissociative mechanism :

$$K = \frac{\theta}{(1-\theta)P} \tag{1}$$

Using standard thermodynamic equations :

$$\Delta G^o = -RTLn\left\{\frac{\theta}{(1-\theta)P}\right\} \tag{2}$$

$$\Delta S^o = -\left(\frac{\partial \Delta G^o}{\partial T}\right)_p \tag{3}$$

$$\Delta S^o = RLn\left\{\frac{\theta}{(1-\theta)P}\right\} + \frac{\Delta H^o}{T} \tag{4}$$

In the lagmuir theorem ΔH^o is taken to be a constant so,

$$\Delta H^o = -RT^2\left(\frac{\partial Lnp}{\partial T}\right)_\theta = const < 0 \tag{5}$$

From equation (5) it easy to see that :

$$Lnp = -\frac{C}{T} + K(\theta) \tag{6}$$