Chemical vapor Deposition (CVD) is one of diamond synthesis process and it is widely applied to cutting tools to enhance wear resistance and increase tool life. The presence of excessive Co on the substrate of cemented tungsten carbide has a negative influence on the deposition diamond. Single step pretreatment leading to both Co removal and the roughening of the substrate surface can improve adhesion levels of the diamond coatings deposited onto WC-Co substrates. The effect of cobalt content on the diamond adhesion on WC [6%Co] is well documented. However, very limited research has been reported on WC [12%Co]. In this present work, an attempt is made to study the effect of pretreatment parameters namely temperature and time on cobalt removal and surface roughness of WC [12%Co]. Full factorial experimental design followed by Response Surface Methodology (RSM) is employed in this study to plan and analyze the experiment. The surface roughness (Ry) and cobalt removal are the independent response variables. Empirical models are successfully developed to predict amount of cobalt removal and surface roughness of the substrate using both Genetic Algorithm (GA) and design of experiments (DOE) methods. Experimental results show that the temperature is the most significant factor followed by the etching time for predicted surface roughness (Ry). Whereas for interaction of time and temperature are not significant to influence Ry. In contrast time of etching is more significant than temperature for cobalt removal during pretreatment process. Moreover, interaction of time and temperature is also significant to influence cobalt removal