WALNUT SHELL EXTRACT AS SUSTAINABLE, ECO-FRIENDLY AND COST-EFFECTIVE GREEN CORROSION INHIBITOR FOR FABRICATION OF ACTIVE PROTECTIVE NANOCOMPOSITE COATING BASED ON MESOPOROUS CARBON HOLLOW NANOSPHERES

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This paper presents anticorrosion performance of epoxy resin containing walnut extract as green inhibitor doped in mesoporous carbon hollow nanospheres (MCHNSs). In the first step, mesoporous silica hard templating method was used to fabricate carbon hollow nanospheres. In the second step, the extracted green inhibitor was loaded into the nanospheres (WE@MCHNSs) and on-demand active coating was fabricated by uniformly dispersing doped carbon nanospheres in epoxy matrix. The corrosion protection properties of the coatings were studied by electrochemical impedance spectroscopy (EIS), electrochemical noise measurement (ENM) and salt spray analysis. Corrosion resistance of the mild steel samples in the 3.5 wt. % NaCl solution in the presence and absence of walnut extract was compared. Salt spray and electrochemical impedance spectroscopy (EIS) results proved active protective behavior of the epoxy coating containing the doped MCNSs. It was shown that charge transfer resistance of the bare steel sample enhanced from ~ 610 Ω cm^2 to ~ 4060 Ω cm^2 in the presence of WE after 24 h immersion time. Also, the active corrosion protective performance of the scribed coatings was improved ~ 1450 % in the presence of WE@MCHNSs. The obtained results revealed that on-demand release of walnut green inhibitors from carbon nanospheres enhance protection performance of epoxy coatings. Furthermore, the fabricated epoxy coating demonstrated active protection behavior due to release of inhibitor caused by mechanical damage of carbon nanospheres shells (Figure 1).

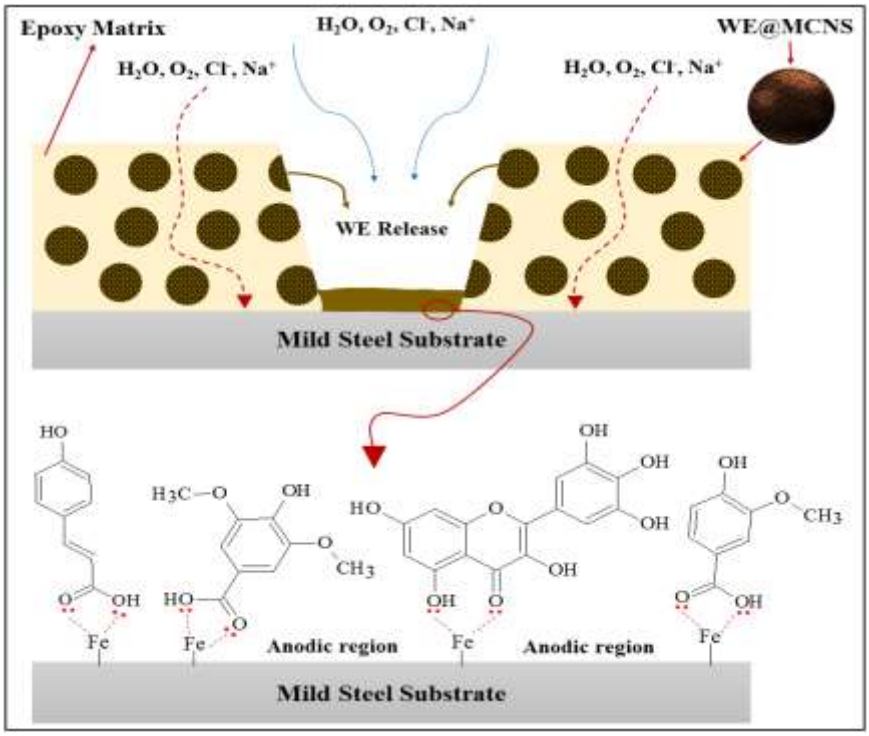

Figure 1: Possible schematic illustration of the film formation along the scratched area in the presence of WE@MCNSs.