Enhanced corrosion resistance of reinforced concrete: Role of emerging eco-friendly Elaeis guineensis/silver nanoparticles inhibitor

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ABSTRACT

Silver nanoparticles (AgNPs) doped palm oil leaf (*Elaeis guineensis*/EG) extracts (EG/AgNPs) were prepared as novel, non-toxic, and eco-friendly corrosion inhibitor; which were incorporated in cement composite and examined against reinforcement steel corrosion in natural seawater. Standard corrosion monitoring techniques including linear polarization resistance (LPR), potentiodynamic polarisation, half-cell potential (HCP) and electrical resistivity were used to screen corrosion inhibition potential of EG/AgNPs enabled steel reinforced concrete after exposing them weekly to wet and dry cycles in seawater. Besides, the microstructural, morphological, thermal and elemental properties of such concrete at 365 days of exposure were determined. The microstructures of powder of EG/AgNPs inhibitor, pre- and post-treated concrete (powder and small pieces) as well as the steel reinforcement surface were analysed. Incorporation of 5% green EG/AgNPs inhibitor into the steel reinforced concrete revealed enhanced corrosion resistance, where a protective thin barrier was developed over the steel reinforced surface. This improvement was attributed to the formation of extra calcium silicate hydrate (C-S-H) gel in the concrete and thereby blocked the concrete pores. The maximum inhibition efficiency was recorded to be as much as 94.74%. It is established that these green EG/AgNPs has prospective for optimum corrosion inhibiting treatment to achieve durable concrete structures.

KEYWORDS:

EG/AgNPs; Green corrosion inhibitor; Corrosion resistance; Reinforced concrete; Half-cell potential; Morphology