Preparation and evaluation of rust removal solution for anti-corrosive properties

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ABSTRACT

The deterioration of metal surface especially iron due to oxidation or other chemical reactions results in the formation of rust. Rust consists of hydrated iron (III) oxide ($Fe_2.O_3.nH_2O$), which is generated when iron, is in contact with both moisture and oxygen. The formation of rust causes enormous loss to the economy of the country and compromises the integrity of the structures. Therefore, there is a need to develop solutions which can remove rust from metallic surfaces. The objective of this study was to prepare some rust removal formulations using selected reagents and to evaluate their rust removal properties. The formulations were prepared using compositions of different low molecular weight organic acids (LMWOs) at room temperature. Formulation One contained citric acid, sulphamic, and iron sulphate whereas, formulation two was composed of acetic acid, sulphamic acid, and iron sulphate. Formulation three contained hydroxyacetic acid, sulphamic acid, and iron sulphate. Formulation four composed oxalic acid, sulphamic acid, and iron sulphate, whereas formulation five was composed of extracted citric acid, sulphamic acid, and iron sulphate.

The study established that the % rust removal for formulation one was in the range of 35-63%, 71-85%, and 77-92%, after 30 minutes, 60 minutes, and 90 minutes respectively. The percentage of the rust removed by formulation two ranged from 38-60%, 60-87% and 73-79%, after 30 minutes, 60 minutes and 90 minutes, respectively. The percentage rust removal by formulation three was 62-77%, 78-81% and 55-88% while for formulation four the range was 14-29%, 32-63% and 11-21% and for formulation five the range was 0.3-66%, 0-1.6 % and 0.7-1.9 % after 30, 60, and 90 minutes respectively.The study showed that at room temperature the percentage rust removal was in the following order: Formulation 1, 77-92%, formulation 3, 78-88% after 90 minutes while formulations 2 and 4 were of 60-87% and 32-63% after 60 minutes respectively. The percent rust removed from the metal surface depended on the nature of formulation.

FTIR analysis was conducted on the composition of all formulations before and after the reaction with the rusted metal surface to establish the functional groups involved in the process of rusting. The FTIR study showed that major peaks in the formulations, with the peaks; shrinking or prolonging, disappearing, or shifting their position. Based on the performed study, the prepared formulations indicated the ability to remove rust from the rusted nails, meeting the objective of this project whereby the amount of removed rust depended on the nature of the formulation, thus the formulations can be prepared to remove rust on the rusted materials, especially formulation one as it emerged to be optimum at the room temperature.