FORMATION OF A LESS CORROSIVE CEMENT REMOVER USING MILD ACIDS AND FUNCTIONAL ADDITIVES

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Conventional cement removal agents predominantly rely on strong inorganic acids such as hydrochloric, phosphoric, and sulfuric acids. While effective in dissolving cement residues, their use is associated with severe drawbacks, including metal corrosion, surface damage, environmental pollution, and health hazards. This study aimed to develop a sustainable, less corrosive cement remover using organic acids and other functional additives while retaining high dissolution efficiency. A series of formulations were prepared using sulfamic acid (SA), citric acid monohydrate (CAM), sodium D-gluconate (SG), and a non-ionic surfactant (NIS) in varying proportions ranging from 5-15% (w/w) of SA, 5-10% (w/w) CAM, 5-10% (w/w) SG, and 1% (w/w) of NIS. Cement dissolution efficiency was evaluated through weight loss measurements of pre-dried cement cubes at multiple time intervals. Formulations F-03 (with 5% each of SA, CAM and SG) and F-07 (with 10% SA, 5% each of CAM and SG) demonstrated superior performance, which was further enhanced with the incorporation of Tween 20, a non-ionic surfactant (1% w/w). The optimized formulations effectively disrupted the calcium-silicate-hydrate (CSH) network while maintaining low corrosiveness and pH stability at around pH=4, minimizing potential damage to metal surfaces. Upon incorporation of the NIS, percent dissolutions of cement cubes using F-03, and F-07 after 24 hours were respectively 88.2% and 71.0%. These values were higher in comparison to the formulations with no NIS (F-03- 85.5%, F-07- 69.6%). The cement removal mechanism can be explained mainly through acid attack and calcium complexation assisted by the acidity and descaling power of SA, acidity of CAM, chelation properties of SG and wetting power of NIS. The findings provide a scientific basis for environmentally friendly cement removers, offering safer and efficient alternatives for construction maintenance and industrial cleaning applications.

Key words: Cement mortar, CSH, Less corrosive cement remover, Sustainable cement remover