Expired N-acetyl cysteine-containing drug as green corrosion inhibitor for bronze exposed to 3.5 *wt.*% NaCl and simulated acidic rain environments

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The present paper aims at exploring the performance of an expired commercially available drug named "Fluimucil solution for inhalation" as green corrosion inhibitor for bronze in two corrosive environments simulating the basic seawater (3.5% *wt.* NaCl) and an acidic rain (0.2 g L^{-1} $NaHCO_3$ + 0.2 g L^{-1} Na_2SO_4 + 0.2 g L^{-1} $NaNO_3$, pH 3.4) encountered in a highly polluted industrial atmosphere. The active ingredient from "Fluimucil solution for inhalation" is N-acetyl cysteine (NAC) which is a safe and inexpensive medication approved by the Food and Drug Administration.

The electrochemical investigations performed by Tafel polarization and EIS measurements consistently revealed that the inhibiting behaviour of the expired drug on bronze depends on its concentration in both investigated electrolytes. NAC-containing drug acts mainly as a cathodic-type inhibitor, and its maximum inhibition efficiency is higher in the acidic rain simulating solution as compared to 3.5 *wt.*% NaCl media.

The surface analysis showed that the addition of the expired drug in the two corrosive electrolytes resulted in the formation of a thin adsorbed inhibitor film on the metallic surface, which effectively protects the bronze against corrosion.

The adsorption of NAC on bronze surface obeys Langmuir isotherm in both corrosive media.

The environmentally friendly properties of the expired NAC-containing drug make it favourable to be used in practice, replacing some toxic corrosion inhibitors, in accordance with the ecological policies for the use of chemicals.