

ORIGINAL PAPER

Efficacy of zinc and tourmaline in mitigating corrosion of carbon steel in non-flow mode

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Laboratory corrosion immersion tests were carried out to investigate the effectiveness of a physical water treatment (PWT) using zinc and ceramic tourmaline-based catalytic materials for the control of carbon steel corrosion in acidic still water (i.e., pH 4.5–5). The tests were carried out at different water temperatures over 168 h. Our results showed a maximum of 22 % reduction in the corrosion rate using PWT in comparison with the control case. Furthermore, the corrosion products depicted more agglomerated particles after the PWT treatment. In both cases, differences were observed in the crystal structures, showing in general lower corrosion activity when PWT was used. The present results could find potential applications in water distribution systems and where metallic materials are exposed to stagnant acidic water.

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Introduction

Corrosion is an ongoing problem in water distribution and piping systems in domestic and in industrial settings such as the oil and gas industries, and grinding mills (Somerscales, 1997; Tao et al., 2005; Biomorgi et al., 2012). It entails approximately 1–5 % of the GNP of any country (Javaherdashti, 2000;

Melidis et al., 2007). Corrosion never ceases but its scope and severity can be mitigated (Amin & Khaled, 2010). The presence of corrosion in pipes restricts the flow of water and also degrades the water quality, with economic, hydraulic and aesthetic effects (Sarin et al., 2001; Świetlik et al., 2012). The most common means of inhibiting or controlling corrosion are chemical additives and inhibitors (Raja & Sethura-

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