A method for inhibiting scale formation and corrosion in a cooling water system

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ABSTRACT

The polymeric inhibitors made show promise inhibiting corrosion and scale formation in the recirculating cooling water system. In this paper, polymer blends were prepared by mixing an anionic polymer, poly(acrylic acid) and polyaniline dispersion. The blends have been evaluated for their effectiveness to retain the dissolved minerals in the cooling water and to protect carbon steel against corrosion in alkaline recirculating cooling water conditions. Monthly water analyses have been conducted on makeup and recirculating cooling waters in the presence of the new treatment, and the active chemical components were monitored. Stressed system conditions have been established by increasing the temperature (15–50°C) and cycles of concentration (1.5–4.5 cycles) to perform a series of scales and corrosion tests. The results obtained from these studies show that the present polymer blends used at 100 ppm concentration have an inhibiting effect on the calcium and magnesium scales up to 91 and 82%, respectively. The weight loss and corrosion polarization resistance method (Corrater system) measurements were carried out to investigate the ability of polymer blends to inhibit within the aqueous system the corrosion of carbon steel. An inhibition efficiency of nearly 81% is achieved for 100 mg/L concentration of polymer blends.

Keywords: Cooling water; Acid-free conditioning; Mineral deposition; Corrosion inhibitor; Scale inhibitor; Poly(acrylic acid); Polyaniline dispersion

1. Introduction

Water is the most commonly used cooling fluid in industrial systems, such as in heat exchangers, cooling towers, and related equipment. Depending on the quality and availability of fresh water supply, the recirculating cooling water systems contain varying amounts of solids suspended or dissolved, most likely both [1]. Dissolved solids usually consist of mineral complexes in the form of crystals, which in a process described as nucleation continue to grow; they are characterized by the extent of their solubility and especially of their potential insolubility at particular temperatures.

A full description of the open recirculating cooling water systems used in these studies, with further details, is given in the section “Corrosion and scale evaluation equipments”. In cooling water plants, the water losses can occur by evaporation, windage, and...