Abstract

Our study focuses on the prevention of the scale deposits formation in Bounouara hard waters, having a hardness of 60°f by two environmentally compatible methods: by using natural inhibitors and by controlled electrodeposition of Ca^{2+} and Mg^{2+} on a stainless-steel cathode at a constant applied current intensity.

Aqueous extracts of natural food waste (strawberry leaves, tomato leaves, pomegrenate peels, mandarin peels and mandarin leaves) have been utilized as new bio inhibitors to reduce the formation of tartar in Bounouara hard water. After biotreatment of the Bounouara water, the inhibitors were removed using the anodic oxidation method using a BDD electrode.

The results showed that the raw water of Bounouara is very scaly water with scaling time of 16 min at 20°C and that it becomes more scaly water at a higher temperature. The impedancemetry confirmed that the Bounouara raw water scale deposits are compact and adherent by highest charge transfer resistance value obtained. The deposits consist mainly of calcium carbonate in the form of calcite, $CaSO_4$ and $CaPO_3(OH)$ crystals. The electrochemical evaluation proved that the scaling time increases as the concentration of natural inhibitors increases. The charge transfer resistance values of the treated Bounouara water show a decrease in the amount of the tartar and its adhesion. the strawberry leaves extract is the most effective inhibitor, because it reacts at very small concentration (1ppm at 20°C and 2,5 ppm at 40°C). Anodic oxidation allows to recover the transparent color of Bounouara water after treatment by natural inhibitors.

The controlled electrodeposition of Ca^{2+} and Mg^{2+} on a stainless-steel cathode at constant applied current intensity was also used to prevent the scale formation in Bounouara hard water. It was found that : Ca/Mg ratio influences inorganic carbone removal rate. An increase in stirring speed or cathode geometric area favors inorganic carbone, Ca^{2+} and Mg^{2+} removal rates. The most effective applied current intensity is the value of 0.1 A. The deposit formed over the cathode does not seem to influence posterior deposition rate, and after eight consecutive assays, the solid deposition rate was kept constant.

Key words : Hard water**,** Scaling phenomenon, Natural inhibitors, natural food waste, Chronoamperometry, Impedancemetry, Calcite, Anodique oxidation, Electrodeposition.