ELSEVIER

Desalination 217 (2007) 85–92

DESALINATION

www.elsevier.com/locate/desal

# Calcium carbonate scale inhibition using the "allotropic cell" device

E. López-Sandoval[a], C. Vázquez-López[a*], B.E. Zendejas-Leal[a], G. Ramos[b], E. San Martín-Martínez[c], N. Muñoz Aguirre[d], E. Reguera[e]

[a]*Depto. de Física del Cinvestav-IPN, Apdo. postal 14-740, México 07000, D.F. México*
*Tel. +52 (55) 5061-3800; Fax: +52 (55) 5061-3388; email: cvlopez@fis.cinvestav.mx*
[b]*Cicata-IPN, Cerro Blanco 141, Col. Colinas del Cimatario, C.P. 76090, Queretaro, Qro, México*
[c]*Cicata-IPN, Calzada Legaria No. 694, Col Irrigación, México 11500, D.F. México*
[d]*Programa de Ingeniería Molecular del Instituto Mexicano del Petróleo, Eje Central Lázaro Cárdenas 152, Col. San Bartolo Atepehuacan, México 07730, D.F. México*
[e]*Institute of Materials and Reagents, University of Havana, San Lazaro and L. Vedado, 10400 Havana, Cuba*

Received 11 July 2006; Accepted 18 February 2007

**Abstract**

A study of the scale inhibition in water solutions induced by a galvanic device known as the "allotropic cell" is presented. The scale inhibition effect is related to the release of metal ion impurities of $Zn^{+2}$ and $Cu^{+2}$ from the surface of the device. An induced crystal structure modification of the precipitates with a trend to form the metastable aragonite structure is produced. The antiscale effect results from changes in crystallization behavior promoting bulk solution precipitation rather than formation of adherent scale.

*Keywords:* Scale inhibition; Water treatment; Tyndall effect

## 1. Introduction

The build-up of scale formation in water systems is a serious problem, whose solution normally requires costly chemical softeners. Calcium carbonate is the predominant component of scales deposited from natural water, especially in cooling and in heating water systems.

There is ample evidence in the literature [1,2] that small amounts of metal ion impurities, notably $Zn^{+2}$, $Cu^{+2}$, $Fe^{+2}$, $Fe^{+3}$, and $Mg^{+2}$, can affect the nucleation and crystallization rates of precipitating $CaCO_3$ and induce morphological changes of the crystal habit. For example, a scale suppresion effect is obtained with 1 to 1.5 ppm $Zn^{+2}$ ion, added to the water either by dosing a $Zn^{+2}$ solution or by the release of $Zn^{+2}$ ions through contact with a redox Zn-Cu alloy

*Corresponding author.