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Laboratory studies on magnetic water treatment and their relationship to a possible mechanism for scale reduction

Kenneth W. Busch*, Marianna A. Busch

Department of Chemistry, PO Box 93748, Baylor University, Waco, TX 76798-7348, USA
Tel. (817) 755-3311

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Abstract

Laboratory studies indicate that magnetohydrodynamic effects may be responsible for claims that magnetic treatment devices are sometimes effective for scale control in water-using systems. In addition to enhancing corrosion of metals in the vicinity of the device, or within the device itself, application of the field 90° to the flow of a conducting fluid can alter the hydrodynamics of fluid flow. Depending on experimental conditions, this may increase or decrease turbulence in the fluid, promoting aggregation or deaggregation of both ferromagnetic and diamagnetic colloids. Important factors in promoting magnetohydrodynamic forces on fluid flow include conductivity of the solution, linear flow velocity of the fluid, and the flux density (magnetic induction) of the transverse field. Finally, magnetic treatment devices that are physically designed to create additional turbulence by constricting or otherwise altering fluid flow may further enhance the anti-scaling effect by purely mechanical means.

Keywords: Magnetohydrodynamics; Magnetic water treatment; Scale prevention

1. Introduction

Non-chemical water treatment devices were first proposed as a means of scale control in 1865 [1,2]. In 1873, A.T. Hay received the first US patent for a water treatment device that employed a magnetic field [3]. Today, many of these devices are commercially available. Some employ one magnet, some two or more. In some, the magnet is located inside the pipe through which the treated water flows; in others the magnet is placed outside of the pipe. Although the variety of devices on the market may seem nearly infinite, most can be classified into four basic types [4].

Whatever the design, even a cursory review of the literature surrounding these devices reveals numerous contradictions in claimed effects, low

*Corresponding author.

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