



## Effects of permanent magnetic field on calcium carbonate scaling of circulating water

Lili Jiang<sup>a,\*</sup>, Jianliang Zhang<sup>b</sup>, Dongkui Li<sup>c</sup>

<sup>a</sup>*School of Material Science and Engineering, Lanzhou University of Technology, Langongping Road, 730050 Lanzhou, Gansu Province, P.R. China*

*Tel. +86 0931 2976378; Fax: +86 0931 2976702; email: [jianglili2002@163.com](mailto:jianglili2002@163.com)*

<sup>b</sup>*School of Metallurgical and Ecological Engineering, University of Science and Technology Beijing, Xueyuan Road, 100083 Beijing, P.R. China*

<sup>c</sup>*School of Information Science and Technology, Baotou Teacher's College, Kexue Road, 014030 Baotou Inner Mongolia, P.R. China*

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### ABSTRACT

In this paper, experimental results on the effect of magnetic field on the precipitation process of calcium carbonate scale from hard water are reported. Permanent magnets with different magnetic flux densities are used for investigating the effect of magnetic field on induction time, electrical conductivity, total alkalinity, and turbidity of water sample. The magnetic flux density range of test equipment is 0.03–3.4 T. The induction time is found to be reduced after magnetic treatment. In other words, the existence of magnetic field increases the nucleation rate of calcium carbonate. The effect of water velocity on induction time is not pronounced. Magnetic field inhibits the reduction of electrical conductivity. The magnetic field inhibits reduction of bicarbonate content and the formation of calcium carbonate precipitation. Turbidity removal efficiency is increased from 60% without magnetic treatment to reach a maximum of 99.48% at magnetic flux density of 0.7 T. In the absence of magnetic field, this ratio was only 18.19% at 1.5 h and its maximum value was 39.14%. There is an optimal water velocity of 1.2 m/s and magnetic flux density of 0.7 T.

*Keywords:* Permanent magnetic field; Calcium carbonate; Scaling

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\*Corresponding author.