EXPERIMENTAL STUDY OF INFLUENCE OF MAGNETIC FIELD ON THE SURFACE TENSION OF WATER

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ABSTRACT

Influence of magnetic field on the surface tension of water was studied. An electromagnet Model EMU-50 was used for magnetic treatment of water. Water was magnetized by applying a magnetic field of strength ranging from 0 (no magnetic field) to 900 Gauss. Time of exposure was varied from zero to one hour. Surface tension was measured after every increment in the strength of magnetic field and time of exposure. Each experiment was repeated for three times and changes in properties were noted. The results showed decrease in surface tension of water sample compared to control. Such type of effect of magnetic field on pH and electrical conductivity of water is also reported in literature.

Keywords: *Surface Tension, pH, Electrical Conductivity, Magnetic Field, Electromagnet.*

INTRODUCTION

The possibility of making changes in the structure of water was first observed by Vermeirem and patented the technique in 1953. Thereafter the study of applying magnetic field to water was done by number of researchers. Gher, Zhai and others studied the changes in structure of water after exposing it to magnetic field and found that the changes occurred are very important in large number of applications [1]. K. T. Chang et al and many others also showed that an external magnetic field and the changes in structure of water are related and the changes are associated with the hydrogen bonds [2-6]. A. Szczes et al. measured the conductivity of water and amount of evaporated water by applying magnetic field for various time intervals. They found that the magnetic field reduces conductivity of water which is inversely proportional to the rate of flow of water. They also found that magnetic field increases the amount of evaporated water. The decrease in conductivity and increase in evaporated amount of water depends upon time of exposure of magnetic field [7]. The same result to increase the rate of evaporation of water due to magnetization was also reported by J. Nakagawa et al. [8].

The effect of magnetic field on electrical conductivity of water was also studied by S. N. Hakobyan and S. N. Ayrapetyan [9]. N. Hirota et al. And A. Sugiyama et al. observed that the presence of magnetic field stimulates the rate of dissolving of oxygen and copper sulphate in water [10, 11]. An increase in viscosity of water under the influence of magnetic field was reported by S. A. Ghauri and M. S. Ansari and the fact was explained on the basis of stronger hydrogen bonds [12]. Hosoda et al. reported an increase in refractive index of water at atmospheric pressure under the influence of magnetic field of strength 10 Tesla [13]. J.S. Baker et al. and some others reported the application of magnetized water to prevent scale formation in water pipelines [14-18]. Increase in growth rate of plants and animals, faster healing of wounds, broken bones and soft tissue are some other applications of magnetic treatment of water found in literature along with the de-scaling or inhibiting of the scaling of metallic surfaces [19-23].

MATERIALS AND METHODS

Sample of water was collected from three different bore wells located at different places. The samples were labeled S_1, S_2 and S_3. The samples were filled in three different clean bottles and maintained in the laboratory. An electromagnet Model EMU-50 was used for magnetic treatment of water samples. Water was magnetized by applying a magnetic field of strength ranging from 0 (no magnetic field) to 900 Gauss. Time of exposure was varied from zero to one hour. Surface Tension of samples was measured after every stage of magnetization.

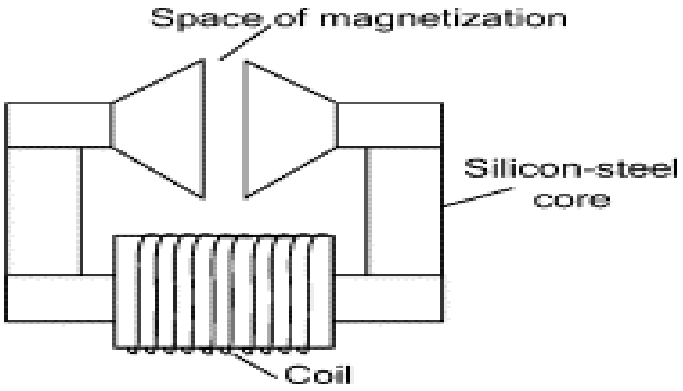

Figure: 1 Bipolar method of water magnetization

Samples of water were magnetized by using bipolar magnetizing method. The schematic diagram is shown in figure [1]. Surface Tension was measured by capillary rise method.

RESULTS AND DISCUSSION

Three samples of water were subjected to magnetic field of five different strengths viz. 100 Gauss, 300 Gauss,

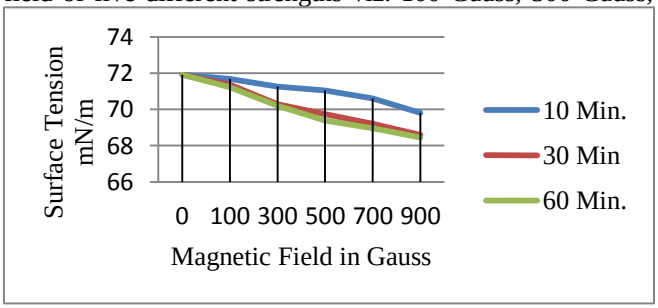

Figure: 2 Variation in S. T. of sample S_1

500 Gauss, 700 Gauss and 900 Gauss. Each sample was subjected to magnetic field of a fixed strength for three different time intervals viz. 10 Minutes, 30 Minutes and 60 Minutes. Every time after exposure to magnetic field surface tension of samples were measured.

Minimum reduction in surface tension of 0.3% was observed for 100 Gauss magnetic field applied for 10 minutes and 2.9% of reduction was observed for the same field applied for 60 minutes. Reduction in surface tension goes on increasing as the strength of field and time of exposure is increased. For the maximum value of magnetic field (900 Gauss) and for maximum value of time of exposure (60 minutes) reduction observed was 4.8%.

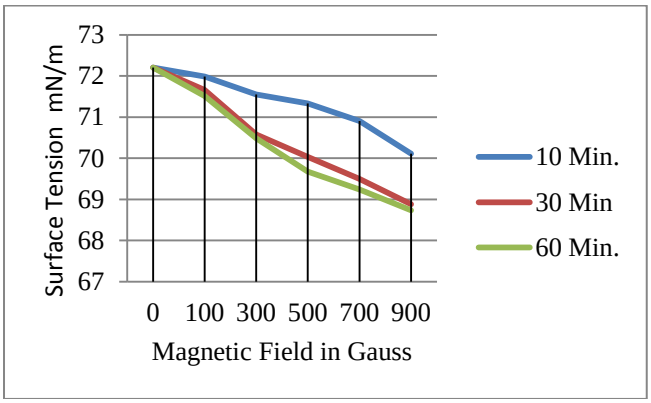

Figure: 3 Variation in S. T. of sample S_2

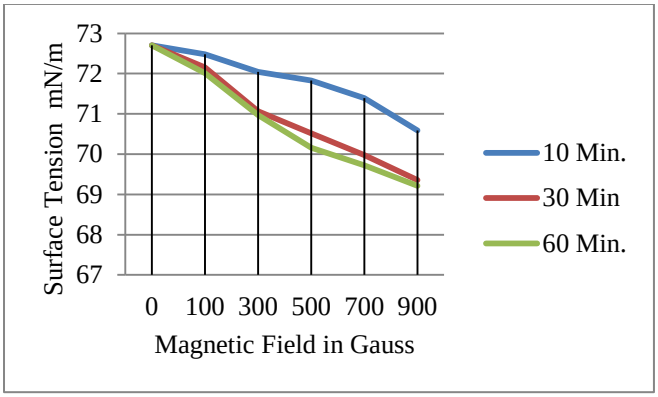

Figure: 4 Variation in S. T. of sample S_3

CONCLUSION

Magnetic field reduces the surface tension of water. Reduction in surface tension depends on both the strength of magnetic field and the time for which sample is subjected to magnetic field. Our results are in very good agreement with the results obtained by other researchers. Reduction in surface tension increases the absorption capacity of water. Hence such water can be used as a very good solvent for various chemical reactions.

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