A mathematical model to predict the amount of aluminum ions in the cooling systems in combined cycle power plants using factors affecting corrosion

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Abstract

In today's world the human needs for electric power is inevitable, hence, the power plants, as generators of electricity, are having of special attention. The cooling systems are among the most important units in power plants. Due to the constant water contact with these units, there is always the risk of corrosion in these units. Because of this, having the knowledge of corrosion situation in these units is very important. By predicting the working ability of the system and the probability of corrosion, one can draw the prevention strategies and the needs to avoid problem creation. In a 2-year case study in Shariati combined cycle power plant of Mashhad, by measuring the parameters affecting the Al ion concentration in the cooling system, these factors were identified. Following this, in examining the behavior and the effects of each of these factors using genetic algorithm, a relation to calculate the concentration of aluminum ions using these parameters and their usage range was given.
Keywords: power plants, cooling systems, corrosion, Al ion, a mathematical model.

1. Introduction

Nowadays, the corrosion and destructive factors have reserved a specific discussion in the countries because of staggering costs such as undesirable sending out the power plant boilers from the cycle. Although the replacement of a pipe or a component in a power plant may cause a lot of costs; its sending out from the cycle at the time of repairing may cause lots of damages daily [1].

The corrosion of the internal surfaces (the corrosion of the pipes' internal areas or those of the tubes) is usually appeared in water and steam tubes and essentially seen as a hole and positional. Corrosion The above mentioned phenomenon is a function of the quality control of water supply for chemical composion, preparations and also acid washing in the power plant which frequently causes corrosion if not paying the required attention [2].

Data show that the annual damages of corrosion are very high. The estimated corrosion damages are about 2-4 percent of Gross National Product (GNP) in industrial developed countries but in the countries like Iran that usually don't make use of the methods of corrosion prevention, in most, cases the damages and costs of corrosion are hidden in the form of repairing costs, so the corrosion damages can be increased to 5 percent of GNP [3].

Some of the analysts divide the corrosion losses into three categories which are waste of material and energy, economical damages and the environment and security risks. Economic damages form a large part in the corrosion issues. These damages include the costs of replacing the parts, systems machinery or related components also, the costs of applying protection methods like painting and repairing and maintaining or installing cathode protection systems which we can classify them as direct damages. Indirect damages include items such as efficiency reduction, physical deformity, and production lost and so on. So, it should be noted that in power plant, corrosion can cause a very important problem; therefore continuous and precise control is necessary [4]