
Controlling Coagulation Process: From Zeta Potential to Streaming Potential

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Abstract: This review concerns the using of Zeta and streaming potentials in the coagulation process control. Coagulation process is usually explained by charge neutralization mechanism. The negative charge may be quantified by Zeta potential or streaming potential measures. Prior to the advent of streaming current monitors, Zeta meters were the primary instruments for measuring electrokinetic properties as related to coagulant dose. Both instruments measure the potential and indirectly the particle surface charge, but use very different methods. Even if the on-line streaming current monitor can provide coagulation process optimization when properly installed, maintained, and interpreted, jar tests experiments and Zeta meters remain indispensable.

Keywords: Electrophoretic Mobility, Zeta Potential, Streaming Potential, Streaming Current, Streaming Current Detector, Coagulation Control

1. Introduction

Conventional water technology implies the treatment of extremely complex colloidal dispersions through coagulation/flocculation process [1]. Coagulating such colloids is achieved through controlling their surface electrical charges. This action is realized by adsorption of ions of opposite charge to the colloid surface [2,3]. This adsorption decreases the mutual electrostatic repulsion between dispersed colloids that prevents their aggregation into flocs [4-6].

This mechanism is called charge neutralization control [7-10]. Controlling the resultant electric charge of the colloid is the main key to the successful steps implicated in aggregation of colloids in raw waters [5,11]. In 1966, the streaming current detector was invented [12]. Prior to this device, there was no on-line, efficient tool to control a characteristic proportional to the value of charge neutralization other than to control its result (in other words,

coagulation as studied in simple jar tests) [5,13,14].

In this review paper, we discuss the evolution from Zeta potential to streaming potential as a mean for coagulant control. As these parameters are related to the colloid charge, we also briefly discuss the mechanism of charge neutralization.

2. From Zeta Potential to Streaming Potential

For over 30 years, with a large success streaming current monitors have been used for on-line coagulant and polymer control in water and wastewater plants [15]. Before 25 years, users have not at their possession an appropriate mean to check-up the on-line unit operation and/or response to process variations. As with any control device, when the reading or output varies, users have to know if it is due to a process variation, or if something is not correct with the