

Gelation kinetics of colloidal dispersion gels by viscoelastic-rheological methods

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Abstract. Colloidal dispersion gels are one of the methodologies implemented, such as chemical recovery processes, in mature wells, their components are mainly polyacrylamide and aluminum citrate, both aqueous unlike other types of gelling, in this there is an intramolecular process, between the polymer chains and the crosslinker, generating a ball of polyacrylamide of nanometric dimensions. The usual gelling processes increase the viscosity of a fluid because of an increase in the molecular weight of the polymer, but in this case, the viscosity of the fluid decreases to the point of being close to that of the solvent, for this reason a monitoring of its gelation kinetics, in a conventional way is not possible, in view of this problem, this research implements techniques of viscoelastic characterization of fluids, to determine the loss and storage modulus G' and G'' , as well as the phase angle in the time, in order to learn more about the gelling mechanism, as well as to be able to estimate a reaction speed, from the point of view of viscoelastic variables, the results obtained revealed that despite being gelling, there is a decrease in the storage modulus, to a greater extent than the loss modulus, which implies that the material loses elastic properties, that is, from solid to become a material more viscous or liquid. With this information, an equation was proposed that can be used both in the laboratory and in oil field work. In addition to being extended to fluids with similar behaviors, where the interactions between the polymeric chains and their crosslinker generate a decrease in their elastic properties.

1. Introduction

Colloidal dispersion gels (CDG) are systems composed of polyacrylamide and aluminum citrate, the ease of being injected into water makes these systems very versatile and easy to inject, in Colombia, this type of treatment has been injected in fields such as Dina field and Tello field, in the department of Huila, Colombia.

The interactions between polyacrylamide and aluminum citrate, in this type of fluids is an intramolecular crosslinking, unlike other systems where macromolecular networks are formed, colloidal dispersion gels have structures similar to a ball, which even reach the size of nanometers, due to the formation of these structures, are gels of very low viscosity, and for this reason it is difficult to monitor the gelation kinetics and to know the state of the fluid in its injection process, currently a method known as tiorco gel unit (TGU) is used, but it is a very imprecise method, due to the dependence of the determination of a flow, which is not standardized [1-3].

This research work uses rheological methods, specifically viscoelastic, to determine the gelation kinetics of a colloidal dispersion gel, of 400 ppm of polyacrylamide and a 40: 1 polymer-crosslinker ratio, this being a common composition for this type of systems. The operations in the field with the injection of CDG, have a lot of complications, because, the operators, don't know the exact, gelling

