MODIFICATION OF RHEOLOGICAL POLYMER BEHAVIOUR BY ULTRA-SOUND APPLICATION

M. BARRACÓ-SERRA; MªA. ADRIÁ-CASAS
Departament de Mecànica de Fluids, Escola Tècnica Superior d’Enginyers Industrials, Universitat Politècnica de Catalunya.
Avinguda Diagonal 647
08028 BARCELONA (Spain)

ABSTRACT
In this paper we present the modifications in rheological properties of some polymers by ultra-sound application.

INTRODUCTION
Rheological properties of solution polymers can be modified by application of an ultra-sound process. The modifications in the polymer samples was carried out in order to industrial application. The effects of ultra-sound application consists in a non-destructive structural process of macromolecules, but in an orientation in the same direction of the stresses applied. For this reason, viscosity was modified in function of ultrasound time, centrifugation time, ultra-sound power, molecular weight and all environmental conditions.

MATERIAL AND METHODS
The basic fluid considered in this study consists in Breox polyethylene glycol solutions. Breox polyethylene glycols are polymers of ethylene oxide with the generalised formula:

\[ \text{HOCH}_2(\text{CH}_2\text{CH}_2\text{O})_n\text{CH}_2\text{OH} \]

Breox polyethelene glycols are not appreciably corrosive, are very low toxicity and present no undue hazards to health under normal condition of industrial use. They are stable solvents for many pharmaceuticals, cosmetics, dyestuffs and resines, and are used like lubricants. Molecular weight range tested were 1000, 1500, 4000 and 6000. The concentrations tested were 30% and 50%.
Ultra-sound method

Equipment description

The Labsonic U consists of a generator (with repeating duty cycle), a six foot line cord, a transducer, a standard probe tip (3/4"-19 mm) and two spanner wrenches for changing probe tips.

Principle of operation

the Labsonic U generator produces output power at a frequency of 20 KHz. A piezoelectric transducer in the probe assembly converts the output of the generator into vertical mechanical motion. A solid titanium probe tip submits the fluid to extremely high acoustic pressures and is responsible for the production of a phenomenon called cavitation.

Cavitation is produced by the sudden formation and collapse of vapour bubbles fluid by pressure. Extremely high shearing pressures, temperatures and processes as microdisruption, emulsification and the production of suspensions are the original cause of this cavitation.

Rheological measures

The rheological measures were realised in a Ferranti-Shirley cone-plate viscometer, using the following experimental conditions: a) shear stress vs. shear rate rheograms: maximum speed 50 r.p.m; scanning time 240 s. b) temperature: 20°C.

Test conditions

The ultra-sound application time was in 90 seconds periods, with a pause of 45 seconds for the 6000 and 1500 molecular weight polymers. For the rest of samples the sound application periods were 180 seconds with pauses of 90 seconds.

Powers ultra-sounds were 50 W and 30 W.

A group of polymers which are treated with ultra-sounds, were centrifugated at 8000 r.p.m during 20 min.

RESULTS AND CONCLUSIONS

- Tested solutions of polymers were newtonian under experimental conditions.
- Ultra-sound application time is not very important for the obtained results at own experimental level.
- The centrifugation process is not an outstanding factor in the modification of rheological properties.
- The relationship viscosity-molecular weight is showed in Figure 1.

REFERENCES


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