characteristics of these systems will affect the injectability, syringibility, residence time and maintenance of the gel form at the administration site (Baloglu et al. 2011). Most of the rheological studies done in the past used the viscosity as a parameter to study these properties. However, conventional methods employed for viscosity measurements, destroy the gel structure resulting into false interpretation (Deasy and Quigley 1991). Hence to keep the gel structure intact, oscillatory measurements at low oscillatory angle were proposed to study the viscoelastic properties of the hydrogel (Chang et al. 2002; Baloglu et al. 2011). Advanced stress and strain controlled rheometers are now available which allow the measurements in oscillatory mode without destroying the microstructure of the gel. Oscillatory measurements are conducted in the linear viscoelastic range from which storage/elastic modulus (G′) and viscous/loss modulus (G″) can be calculated, the two moduli are characteristic of the stored elastic energy and the viscous dissipated energy, respectively (Dumortier et al. 2006).

Sol-gel phase transition of LCST systems can also be determined by rheological studies (Gong et al. 2009a; Boffito et al. 2015). Phase transition is determined by performing temperature sweep test at defined rates and analyzing the behavior of the G′ and G″ as a function of temperature. In sol state, at low temperatures, the value of G′ is relatively low than G″ (G′<G″). With increase in temperature, the value of G′ increases and at the temperature when G′ exceeds the value of G″ (G′<G″) phase transition is said to occur. The temperature at which G′ is higher than G″ is referred as sol-gel transition temperature (Lin et al. 2013). G′ reflects the solid like behavior of the elastic component of the formulation and is the measure of the energy stored and regained at each deformation.

Gelation time could also be determined through rheological studies. Gelation time describes time-dependent gelation mechanism. It is defined as the time after which the G′ becomes higher than the G″ at a constant temperature. Gelation time is important to understand the effect of dilution with biological fluids after *in vivo* administration. Rapidly gelled formulation exhibiting short gelation time have less risk of dilution with physiological fluids and the possibility of drainage from the administration site (Chang et al. 2002; Dumortier et al. 2006).

Mechanical properties

The mechanical properties of thermosensitive hydrogels play a significant role in predicting the behavior and performance of these systems. It gives valuable information to formulate a preparation with adequate gel strength, consistency, acceptable viscosity and ease of administration. The mechanical strength of the hydrogels is important both in drug delivery and tissue engineering application. The mechanical properties of the thermosensitive hydrogels is usually studied with the help of a texture analyser (Sinem Yaprak et al. 2012; Singh et al. 2014). Texture profile analysis (TPA) permits to evaluate the textural properties of these hydrogels under different environmental and physiological conditions. Mechanical properties such as hardness, compressibility, adhesiveness, cohesiveness and elasticity are derived from the resultant force-time curve obtained from the TPA. These characteristics are used to quantify sample deformation under compression (Jones et al. 1996; Jones et al. 1997). The mechanical properties of hydrogels are known to be dependent upon the chemical composition and