β-GP hydrogel (Ruel-Gariépy et al. 2002). Another disadvantage of chitosan-β-GP thermosensitive hydrogels is their potential toxicity as they were found to cause inflammatory response *in vivo* (Molinaro et al. 2002).

Pluronics thermosensitive hydrogels have been applied for drug delivery over the past decades. Pluronic F127 is one of the most widely used copolymer, which has lower critical gelation concentration (CGC) and least toxicity among pluronic series (Gong et al. 2013). Pluronics have been used to deliver anticancer drugs *in situ* (Li and Guan 2011) and several protein/peptide drugs, such as insulin, protein (BMP), fibroblastic growth factor (FGF), and endothelial cell growth factor (ECGF) (Jeong et al. 2012a). However, several drawbacks of pluronic F127 have limited its application in drug delivery, such as short duration in subcutaneous layer, fast dissolution rate and non-biodegradability. To overcome these limitations, Yang et al. (2009) have investigated a novel mixed micelle system composed of both pluronic F127 and Tween 80 to deliver chemotherapeutic agent docetaxel for gynecological tumors. Docetaxel loaded in the mixed hydrogel exhibited a sustained release for more than 156 h. Pluronic F127 also has the ability to promote the cytotoxicity of chemotherapeutic agents by enhancing the sensitisation of malignant cells to anti-tumor drugs (Batrakova et al. 1999). Li et al. (2015) has reported that pluronic F127 mediated with aptamer AS1411 was used for targeted delivery of anticancer drug doxorubicin (DOX) to human breast tumor. *In vivo* study has illustrated that the formulation was able to achieve enhance drug accumulation in tumor, improved antitumor activity, and decreased cardiotoxicity.

The synthetic thermosensitive hydrogel PNIPAAm has gained great interest for its LCST around 32ºC while its poor biodegradability has greatly limited its applications as drug delivery system, as it cannot be easily removed from the body once transform into gel at physiological conditions (Li and Guan 2011). One of the approaches to address this drawback is to conjugate the PNIPAAm polymers with the natural hydrogel chitosan. A thermosensitive hydrogel chitosan-g-PNIPAAm with better biocompatibility and biodegradability to delivery an anti-tumor drug curcumin was prepared. The study demonstrated that the chitosan-g-PNIPAAm containing curcumin could induce apoptosis to tumor cells with lower cytotoxicity to normal cells (Sanoj et al. 2011).

Poly (organo) phosphazene-based hydrogels have also attracted great interests in drug delivery for cancer therapy due to their fast gelation rate, nontoxic degradation products (Teasdale and Brüggemann 2014) and low protein adsorption (Zhou et al. 2010).

Tissue engineering and tissue regeneration

Tissue engineering involves the application of the engineering and biomedical principles towards the development of biological surrogates to improve and restore tissue function (Langer and Vacanti 1993). The unique 3D network structure of hydrogels and its hydrophilic properties resembles the biological tissue's actual environments, making them highly biocompatible. Thermosensitive hydrogels in tissue engineering are commonly used either as substrates to enable cell growth and proliferation or as *in situ* injectable gels. When used as substrates the thermoresponsive