

**Micelle Forming Hydrogels for Topical Delivery of Ibuprofen and Sodium Ibuprofen**

A. Waddon &amp; S. NacNeil

*Kroto Research Institute, University of Sheffield, England.*

Thermo-responsive hydrogels based on the amphiphilic triblock copolymer [poly ethylene glycol]-[polypropylene oxide]-[polyethylene glycol] (Pluronic F68) are used to prepare a drug delivery system for the anti-inflammatory drugs ibuprofen and sodium ibuprofen. In aqueous solution, the surfactant copolymers form micelles on the size of 10-100nm. The hydrophobic PPO forms the inner core of the micelle and the hydrophilic PEG forms the outer corona. The most common form of ibuprofen is extremely hydrophobic and insoluble in water; however, it is shown that it can be dissolved in the hydrophobic core of the micelle to form "nano-packets" of drug up to ~2.5 % . In contrast, the polar form of ibuprofen, sodium ibuprofen, is shown to be readily soluble in the hydrophilic matrix material surrounding the micelle.

These co-polymer solutions undergo a sharp transition from a flowing, viscous liquid to a self-supporting clear and transparent gel on heating. This transition is a classical sol-gel transition. The transition temperature decreases with copolymer content. Importantly, the transition can be made to occur at the physiologically important temperature of 37°C by suitable adjustment of composition.

The gelation temperature is affected by incorporation of the drugs. Dissolution of non-polar ibuprofen into the hydrophobic micelle core is shown to decrease the gelation temperature. In contrast, incorporation of polar sodium ibuprofen into the hydrophilic matrix is shown to increase the gelation temperature.