Polydimethylsiloxane Coatings for Controlled Drug Release

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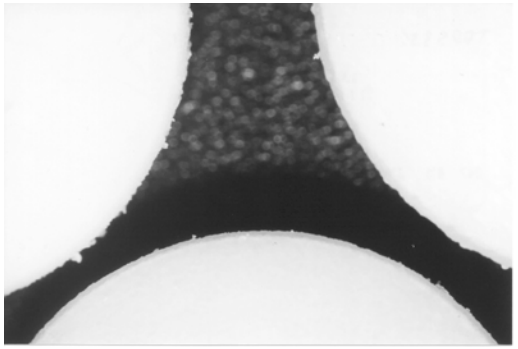
Polymers are uniquely suited as materials of construction for drug delivery system because their permeability can be modified and controlled. They can be shaped and applied relatively easily by a large variety of methods. Active ingredients and property modifiers can be incorporated either physically or chemically.

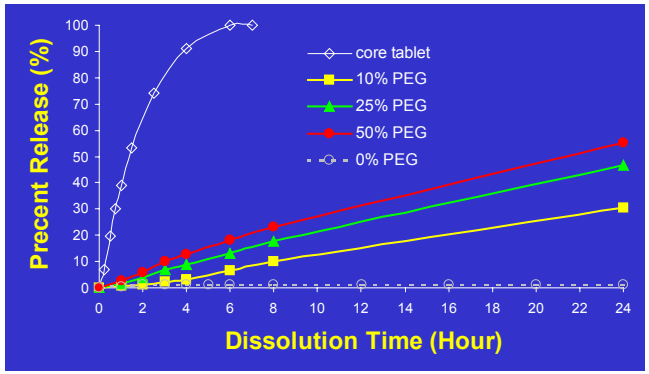
Since poly(dimethylsiloxane) (PDMS) chains are generally prepared so as to have functional groups at their ends, they are readily end linked with multifunctional reactants into the network structures required for elastomeric behavior. The standard reactant is tetraethoxysilane (TEOS) [$Si(OC_2H_5)_4$], which was much used in the preparation of "model" networks for evaluating the molecular theories of rubber-like elasticity. They were also used in some pharmaceutical materials because of their outstanding stability and biocompatibility. Additionally, formulators can benefit from the fact that silicones have very low values of the glass transition temperature. This allows economical manufacturing without the need for elevated temperatures or plasticizers, which are necessary for almost every other polymeric coating system presently available. The image of PDMS coated drug tablets shown demonstrates satisfactory film coatings around the core tablets.

Our results shows drug release profiles in 0.1N HCl for 2 hrs followed by pH 6.8 buffer for 22 hrs. The core tablet (without PDMS film coating) showed 100% release in 7 hrs. However, there was no drug release in 24 hrs if only PDMS was used as the film coating without addition of a channeling agent such as poly(ethylene glycol (PEG).

The addition of PEG gives significant improvements in drug release. Three loadings (10, 25 and 50% w/w) were studied for drug release profiles. The results indicate that increasing the amount of channeling agent results in increases in the total amounts and rates of release. The release rates in 24 hrs show a linear relationship described by an R-squared value for fraction of the variance $R^2 > 0.99$. The slopes of the release profiles represent highly desirable zero-order release rates of the drug from the coated tablets under steady-state conditions.



The optical image of PDMS coated drug tablets



Effects of PEG amount on drug release at pH 1.2 for 2 hrs followed by pH 6.8 for 22 hrs.