ABSTRACT SUMMARY

Recently, a novel process has been developed to enhance or extend the release of small molecules infused throughout polymer films. Through the unique application of heat and pressure stresses, the physical structure of almost any polymer can be manipulated thus allowing for enhanced performance and modified release kinetics. This enhancement has been found to be durable yet can then be reversed gradually over time or with the reapplication of heat.

INTRODUCTION

The use of polymers in the field of controlled release technology has become pivotal in today’s pharmaceutical and home care product markets. The growing demand for extended releasing formulations as well as the ever increasing communal concern about environmental impact has made it even more of an importance to maximize the loading capacity of current delivery constructs while minimizing the implementation of traditional solvent based polymer manipulations.

Currently, surfactants and other additives are used to alter the ability of polymers to encapsulate and release substances such as scent producing perfumes. Through the use of a specific set of pressure and temperature manipulations, polymers can be made to release for longer periods of time without the use of additional chemical manipulation.

EXPERIMENTAL METHODS

Polymer films were produced by melting Polycaprolactone (PCL) and then blending with Fidji essence in a crucible at 60°C. The molten polymer essence mixture was then pressed between steel plates in a mold at pressure and allowed to cool. Upon cooling, discs were punched out of the sample films for analysis.

Samples were stored at room temperature for a period of up to 3 years. Polarized Light Microscopy and Fourier Transform Spectroscopy (FTIR) were used to qualitatively and quantitatively analyze the encapsulation and release results of this unique pressure temperature modified polymer film.

RESULTS AND DISCUSSION

Figure 1 depicts the modified films as observed under polarized light and exposed to different temperatures. The disappearance of the birefringence is an indicator for a morphological change that could be correlated to release rates of small molecules such as perfume. The enhanced PCL was initially field tested by attaching discs to women’s jewelry. The exposure of the discs to body heat was found to have an excellent releasing effect with scent detectable at ranges of up to 2 feet from the wearer. The devices were qualitatively found to maintain their scent for more than 3 years from the date of encapsulation. FTIR analysis (Figures 2,3,4,5) was successfully used to provide a quantitative comparison of the initial materials with the aged samples. Thus the presence of the Fidji essence in the enhanced structure was confirmed.

Figure 1. Polarized Microscopy of enhanced PCL as observed at different temperatures over an 18 month time period.
CONCLUSION

A novel process to enhance the physical structure and small molecule release kinetics of polymers was created. The material properties and release kinetics can be measured by polarized light microscopy and FTIR.

REFERENCES