UNRAVELLING THE MOST PROMINENT VULCANIZATE PROPERTIES FOR PREDICTING SHELF-LIFE OF SURGICAL GLOVES USING ARRHENIUS METHOD

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There are direct and indirect methods for determining the shelf life of polymer products. Direct method requires the product to be under real room temperature conditions for a long period while the indirect method predicts shelf life after exposing the product to accelerated temperature within a short period. This research aimed to identify the most prominent properties that can reliably predict shelf life of natural rubber gloves using the Arrhenius model. Accordingly, surgical gloves were subjected to accelerated ageing tests and predicted properties of the same from Arrhenius plots were compared with real-time storage properties of the gloves stored for five years. Properties such as tensile strength, elongation at break and force at break were found to be the most suitable properties for predicting shelf life of glove using the Arrhenius model.

Keywords: Arrhenius equation, Elongation at break, Modulus, Real-time ageing, Tensile strength

INTRODUCTION

Shelf life prediction determines how a product or component ages during storage and remains competent for use in service conditions. Establishing a storage time limit, known as expiration dating, is a crucial element throughout the entire life cycle of medical equipment (Alexander, 2000; Ciarkowski, 2003; Maisel, 2004; Aziz, 2006). The period for attaining failure of the product is calculated by measuring the amount of degradation that occurs during the ageing process. Natural rubber latex (NRL) surgical gloves were chosen for the study since the product demands reliable prediction of shelf life of the product. Here two types of experiments were conducted, accelerated ageing (Indirect) and real-time experimentation (Direct). In accelerated ageing studies, surgical gloves were exposed to elevated temperatures for a particular period and the degradation was monitored periodically. Accelerated ageing studies for life prediction had been performed with various physical and chemical properties (Brown *et al.*, 2000; Brown, 2001). It was found that tensile stress/strain characteristics were the most appropriate method for conducting accelerated ageing studies due to the simplicity of the test with uniaxial load applied. However, Dinzberg and Bond (1990) found that tensile strength was not very relevant to service conditions since the tensile strength may increase or

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