

Abstract

Unlike other chemical protective clothing and devices, disposable gloves are not reliably certified to exceed chemical permeation performance standards. In light of generalized chemical compatibility charts, significant variability in performance exists between similar products on the market. This study evaluates whether nitrile rubber composition and uniformity are better associated with the observed product variability in chemical resistance than the available mechanical testing (e.g., tensile strength) done on these products. The independent variables evaluated include two physical, three mechanical, and four compositional parameters. Based on correlation and multiple regression analyses, the factors associated with variation in permeation of ethanol are area density, acrylonitrile content, carboxylation of the base polymer, the amount of extractable oils and oily plasticizers, and polymer uniformity. Increases in area density, acrylonitrile content, and carboxylation improve chemical resistance. Decreases in extractable oils and polymer variability (uniformity) also improve chemical resistance. On average, these combined factors accounted for about 53–67% of the observed variability in permeation, which were moderate but not strong associations. In contrast, tensile strength accounted for about 1% of the observed variability, a negligible effect. These results support the notion that standardized tests and certification criteria need to address polymer composition and uniformity to reduce gaps in performance. However, in light of the lack of strong correlations, further evaluation with tighter control over chemical composition is warranted.