



REDUCTION OF ZINC MIGRATION FROM FOOD CONTACT NITRILE RUBBER JAR SEALING RINGS

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Abstract

Zinc oxide (ZnO) is one of the basic indispensable components of rubber compounds, which acts as an activator in the rubber vulcanization process with sulfur and accelerator/s. However, since 2004, the European Union has classified ZnO as a harmful substance for the health, and recently their legislations have consolidated, that the application of ZnO in food contact rubber products to be reduced and controlled. Nano-zinc was used to reduce zinc migration; however, a scientific study was not conducted to explain the reduction of zinc migration. Hence, this research work focuses on the reduction of zinc migration in acrylonitrile-butadiene rubber (also called as nitrile rubber, NBR) based jar sealing rings used in food contact application. In search of finding out a new method to reduce zinc migration, the formation of a chelated zinc complex using ethylenediaminetetraacetic acid (EDTA) as a chelating agent is introduced. Several rubber compounds with varied loadings of nano-zinc (1 to 2 phr) and EDTA (1 to 3 phr) were prepared using a laboratory-scale two-roll mill and compression moulded at 140°C and at 0.2 MPa. Migration test was carried out for all vulcanizates according to BS EN 13130, using 3% (w/v) acetic acid aqueous solution as the food simulant (Simulant type B). Atomic absorption spectroscopy was used to determine the content of zinc in 15 ml of the food simulant. With the increase of EDTA loading, the zinc migration of the vulcanizates was reduced and with 3 phr EDTA loading, 37% reduction of zinc migration was obtained. When replacing the conventional ZnO with nano-zinc loading of 2 phr, 47% reduction of zinc migration was obtained. By adding both EDTA and nano-zinc in 1 phr loadings, 57% remarkable reduction of zinc migration was obtained.

Keywords: Zinc oxide, chelating agent, EDTA, food contact rubber, nitrile rubber