Xiao-qin Wei et al., J Chromatogr Sep Tech 2018, Volume 9
DOI: 10.4172/2157-7064-C1-040

Failure analysis of nitrile rubber O-rings static sealing for packaging barrel

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Nitrile rubber O-rings seals for packaging barrel was stored in China tropical marine atmosphere environments for 10 years, and then the sealing function of nitrile rubber O-ring was failed. By comparing the molecular structure, cross-link density, thermal decomposition, content of elements and chemical functional groups of the original nitrile rubber seals, the surface and interior of nitrile rubber seals storage for 10 years, a long-term natural failure mechanism was studied. The results showed that the surface content of dibutyl phthalate and dibutyl sebacate, the surface carbonyl peak height and the surface content of oxygen element were higher than that in internal; the surface cross-link density was lower than that in internal but still higher than in original sample; and surface carbon-to-oxygen ratio were lower than that in internal and original sample. After aging for 10 years, the weight loss of plasticizer decreased, and the main chain content increased. It can be inferred that nitrile rubber mainly undergoes oxygen-absorbing cross-linking reaction to form carboxylic acids and esters, which is accompanied by the migration and enrichment of two plasticizers to the surface, causing reductions in elasticity. The residual permanent compression set was lower than the design critical value, and the sealing function for the packaging barrel was lost, and a leak occurred.

Biography

Xiao-qin Wei has completed his Master's degree at Southwestern University. She is mainly engaged in drug analysis and material failure analysis. She has published more than 10 papers in well-known journals.

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