

Study of Compatibility and Oxidation Stability of Vegetable Insulating Oils

Authors : Helena M. Wilhelm, Paulo O. Fernandes, Laís P. Dill, Kethlyn G. Moscon

Abstract : The use of vegetable oil (or natural ester) as an insulating fluid in electrical transformers is a trend that aims to contribute to environmental preservation since it is biodegradable and non-toxic. Besides, vegetable oil has high flash and combustion points, being considered a fire safety fluid. However, vegetable oil is usually less stable towards oxidation than mineral oil. Both insulating fluids, mineral and vegetable oils, need to be tested periodically according to specific standards. Oxidation stability can be determined by the induction period measured by conductivity method (Rancimat) by monitoring the effectivity of oil's antioxidant additives, a methodology already developed for food application and biodiesel but still not standardized for insulating fluids. Besides adequate oxidation stability, fluids must be compatible with transformer's construction materials under normal operating conditions to ensure that damage to the oil and parts of the transformer does not occur. ASTM standard and Brazilian normative differ in parameters evaluated, which reveals the need to regulate tests for each oil type. The aim of this study was to assess oxidation stability and compatibility of vegetable oils to suggest the best way to assure a viable performance of vegetable oil as transformer insulating fluid. The determination of the induction period for several vegetable insulating oils from the local market by using Rancimat was carried out according to BS EN 14112 standard, at different temperatures (110, 120, and 130 °C). Also, the compatibility of vegetable oil was assessed according to ASTM and ABNT NBR standards. The main results showed that the best temperature for use in the Rancimat test is 130 °C, which allows a better observation of conductivity change. The compatibility test results presented differences between vegetable and mineral oil standards that should be taken into account in oil testing since materials compatibility and oxidation stability are essential for equipment reliability.

Keywords : compatibility, Rancimat, natural ester, vegetable oil

Conference Title : ICEMPE 2021 : International Conference on Electrical Materials and Power Equipment

Conference Location : Istanbul, Türkiye

Conference Dates : May 06-07, 2021