

New Approach in Insulation System of Power Transformers – Insulating Oils with Less Impact on the Environment

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Abstract

Paper deals with comparison of selected properties of several vegetable oil representatives (commercially available ENVIROTEMP® FR3TM vegetable-based transformer oil, sunflower oil, rape oil and refined sunflower and rape oil) along their accelerated thermal ageing at the temperature of 90 °C. These properties are compared to two widely used and commercially available mineral transformer oils (Technol Y 3000 and Shell Diala DX). Combined insulating system (oil-paper system) was created with the usage of mentioned oils for measurement purposes.

Dissipation factor, capacity and volume resistance are the characteristics measured along the thermal ageing of the oil-paper systems. Infrared spectroscopy was used as the additional method. After 1000 hours of ageing, the dissipation factor of all systems based on vegetable oils did not exceed the value of 0,015. The volume resistance of systems containing mineral oils was approx. twice as high as volume resistance of those with vegetable oils. Capacity on the other hand was slightly lower in the case of mineral oils application. Experiment also showed that paper combined with vegetable oil dries more quickly than in combination with mineral oil. Infrared spectroscopy has not shown any expressive changes in the chemical structure of all tested oils yet. It was proven that all monitored electrical properties of commercially available ENVIROTEMP® FR3TM transformer oil are very similar to the properties of common rape oil. Detailed analysis indicated the properties of paper and rape oil combination as the best from all tested vegetable specimens.

All obtained results confirm the good properties of mineral oils. This fact is caused mainly by their chemical structure. Big accent is put on application of environmental free materials nowadays, which requires as intensive research of alternative insulating oils (vegetable, synthetic oils eventually) as that done in the past with mineral oils.