

Vegetable oils in electric transformers.

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Abstract:- the replacement of mineral dielectric oils by dielectric oils represent a case of improving environmental conditions failure vegetable oils have one much lower biodegradability and are prone to fewer accidents for its high resistance to ignition.

Keywords:- transformers, dielectric permittivity.

I. INTRODUCTION

Substitution of mineral dielectrics by vegetable dielectrics in distribution transformers includes the development of a series of methodologies allowing better performance, better cost and of course less damage to the environment by waste your time of life suggests. In this sense below a set of scientific papers that have allowed characterizing global study of the technological change and the challenges and processes necessary for their development.

II. DEVELOPMENT

In 2009 [1] developed a project to determine the operation of transformers with a power of 90Mva for distribution lines 132 Kv designed, manufactured and tested by Areva T & D, it has been officially activated in Luton, United Kingdom-EdF energy networks. This is the first time that has been used in high voltage on the United Kingdom system, or anywhere a transformer constructed especially for this purpose. The oil used was Envirotemp FR3, an insulating fluid made of Cooper Power Systems; the unit has been built in the factory of Areva T & D in Stafford, United Kingdom. The methodology basically was the manufacture of two transformers of the same specification; the only difference is that one is filled with FR3 Fluid while the other contains conventional mineral oil. About 30000 liters of oil are required to act as coolant and dielectric between the metal tank and inside electrical equipment. A significant percentage of the transformer failures are due to the degradation of the insulating paper. It showed that when the paper is immersed in liquid FR3 this ages more slowly in a mineral oil-filled transformer. One of the main reasons is that liquid FR3 actually reduces the moisture content of the paper. Laboratory tests have shown that impact of the fluid asset management is even more evident when the fluid is used in new transformers. FR3 Fluid retro-filling transformer can typically be charged 12-17% more than a mineral oil transformer and expect the same life of isolation. An additional advantage is the mitigation of fires associated with transformers failed due to very high ignition temperature. In the research carried out by [2] in Romania, consider that today, there is a growing interest in the use of vegetable oils. Respect of mineral oils for applications in distribution and power transformers. The study is mainly the following advantages of vegetable oils compared with mineral oils. Mineral oils have a high flash point (fire) approximately 300 degrees centigrade compared to mineral oils that have a point of ignition of 200 degrees Celsius.

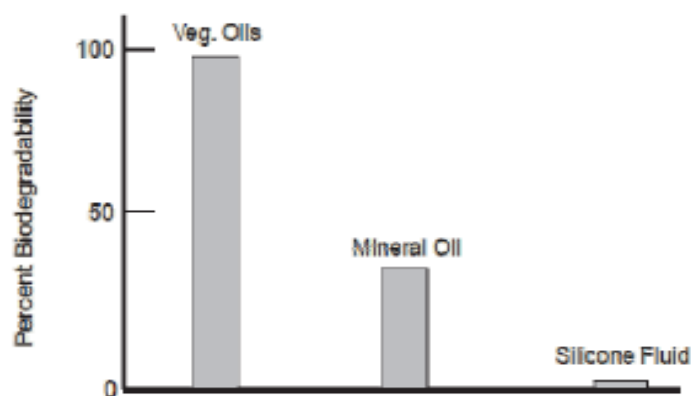


Fig. 1. Degree of biodegradability [2].

Another important aspect is the biodegradability (fig 1), which is one of the aspects most important to considering the need to be more environmentally responsible. They have one affinity for moisture, a saturation limit most high will allow to keep the insulation paper driest allowing this to prolong the life of the transformer. [2] Concludes that the components of the complex permittivity and electrification of vegetable oil flows are greater than the mineral oil and resistivity values are lower in vegetable oil. An empirical relationship is considered to calculate current electrification measured at 200 rpm as a function of the real part of the relative permittivity measurement at 1 MHz. A significant difference between the measured values of the flow in the stream of electrification was not determined. On the other hand [3] highlights two recent projects, one in the United Kingdom and one in Brazil, used vegetable oil instead of mineral oil to the insulating fluid. The objective was to be able to offer customers innovative solutions for a sustainable future. EDF Energy, the United Kingdom has a large number of substations located in densely populated areas, many of them underground and inside buildings. It is therefore installed two 90Mva and 132Kv immersed power transformers one in vegetable oil and the other with mineral oil and a team of monitoring [1] to provide information and compare their performance. Used vegetable oil is soy-based and Envirotamp FR3 manufactured by Cooper Power Systems. The other project shown in [3] is of the company Eletronorte in Brazil has a situation similar but in a different context, this being the be responsibly with the environment since it is a project in the area of the Amazon, so ordered the construction of 242 242 Kv reactor immersed in vegetable oil FR3, whereas the experience gained by the United Kingdom regarding the use of these biodegradable items so. Another important aspect of this project was the average environmental benefits by making it possible to develop equipment with fewer expectations of fire and longer service life, being this very important for the area of the Amazon, rich in biodiversity. [4] Developed a methodology for the study on the use of transformers with vegetable oils and considers that the operation of the electrical transformers is subjected to variations in net charge daily, overload, different ambient temperature, and other factors involved in its functioning. Likewise transformers in its operation are subject to efforts of temperature and electromechanical, that decreases their electrical insulation devices. Despite this, during the operation of transformers dielectric oils coolants have contributed to that will preserve its internal insulation, dielectric properties improve and have inside a cooling medium that helps dissipate the heat that is generated in the coils this work [4] to the vegetable oil for transformers of distribution. The general objective was to analyze the behavior of this vegetable oil, to substitute for mineral oil in transformers. The paper discusses the different properties and performance characteristics of vegetable oil, and compared with the mineral oil commonly used in the market based on ASTM, IEEE and COVENIN procedures; also discussed is its effect on the insulating paper for transformer. [4] Concludes that trials were scheduled in an efficient way and it allowed analyzing the properties and characteristics of the oils, according to the proposed schedule. According to the results obtained in tests of aging, 14 hours to 40 percent of overload it represents a year of life for a mineral oil transformer, while for the vegetable oil transformer, 20 hours that same percentage of overload represents a year of life. Analyzing the results is determined to be the life of a vegetable oil transformer 42.86% superior to the life of a mineral oil transformer.

Also the behavior of insulating paper for transformer was analyzed with the development of other tests, establishing comparisons between mineral oil and vegetable oil. A transformer with vegetable oil, has the ability to work with greater load demands without drastically increasing the temperature, avoiding failures due to overload, and therefore fail in service.

[4] considers two types of tests, one under the conditions of actual operation and another under simulated conditions taking into account for this purpose [5], [6], [7], [8], [9] and [10] as a fundamental basis of the international standards for testing and interpretation in transformers. In this sense [11] it is considered a number of issues that have to do with the architecture and design of distribution and power in terms of its insulation transformer to be a fluid liquid or gaseous and solid materials; It has been used since the early petroleum oils and other materials which by their volatility and level of contamination were forbidden, then also insulating gels were used and are currently esters vegetables with a high degree of biodegradability and high level of inflammation. Within the architecture of the transformers is the set of coils and core where the insulation can be divided into two groups, the main insulation and secondary insulation. The principal is the separation of high and low voltage windings and coils of the core and secondary is used, depending on the design and manufacture, to the parts of the individual coils. The characteristics surrounding the design of transformers with oil insulation are its high dielectric strength, very low costs, resilience to the dielectric overexertion and salient characteristics for heat transfer processes. Oil-immersed transformers are reinforced with several solid insulation, usually prestressed carton (paper) alternating with oil barriers. The insulation used to be placed on top of wires of coils is varnish or rolled paper, insulation directly on the driver use inhibits the formation of shock potential by increasing the electrical resistance of the structure of the transformer.

III. CONCLUSION

In conclusion the different methodologies and projects to change mineral dielectric oils by dielectric oils in distribution transformers are intended to improve the operation of the power systems achieving a better performance at higher temperatures and with less damage to the environment in the event of failure the systems.

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