

RAPO® VEGETABLE INSULATING OIL CHARACTERS

Environmental Character

Environmental friendly

Based on natural plants

Almost 100% biodegradation

Non oral toxicity

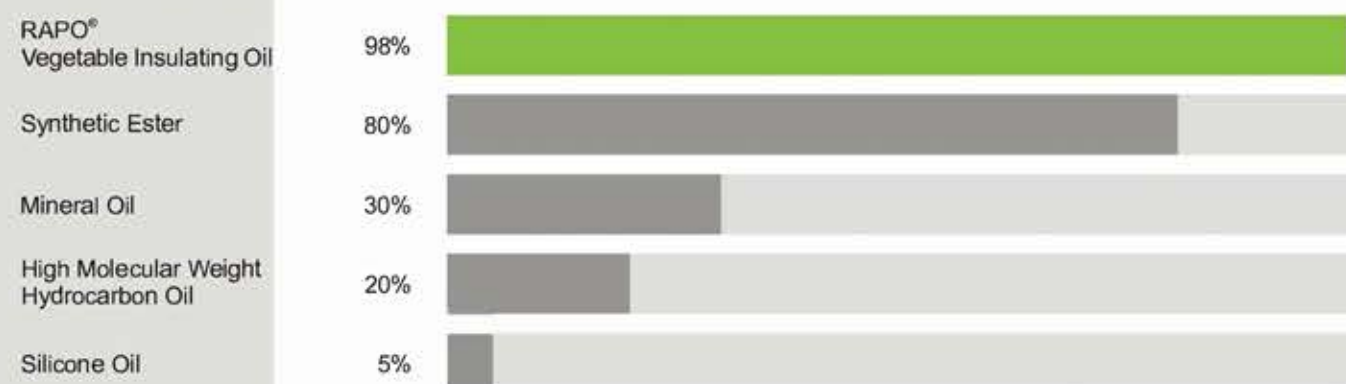
Non toxicity for aquatic animals

None halogen, polycyclic aromatic hydrocarbons

Petroleum independency



Transformer oil biodegradability comparison

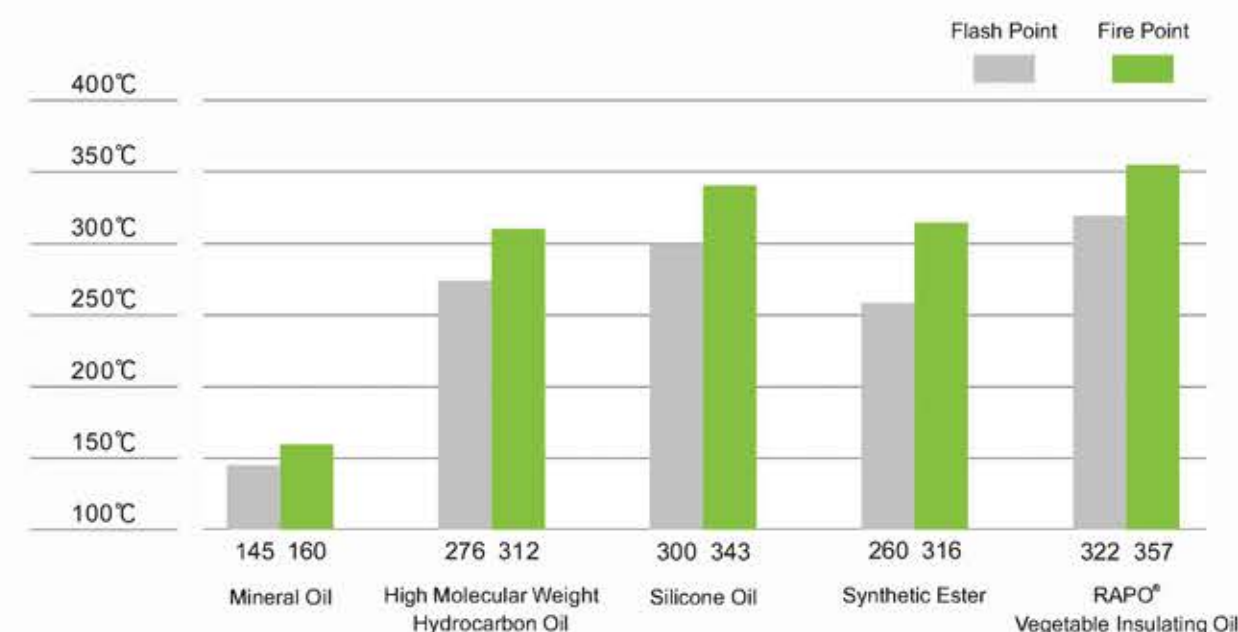


- If RAPO® spillover, it can be cleaned by normal means, instead of the way to deal with toxic waste.
- RAPO® is real green insulating oil which can avoid punishment by government regulations and eliminate the cleanup process.

Less-flammable Character

Mineral oil's fire point is in the range of 147-165°C (296.6-329°F). The relatively lower fire point might result in transformers' fire and explosion. The fire point of RAPO® vegetable insulating oil is up to 350°C, higher than most of fire-resistant oil and other insulating oil in use, greatly improved the safety and reliability of transformers and grid system.

Fireproof performance comparison of various types of transformer oil

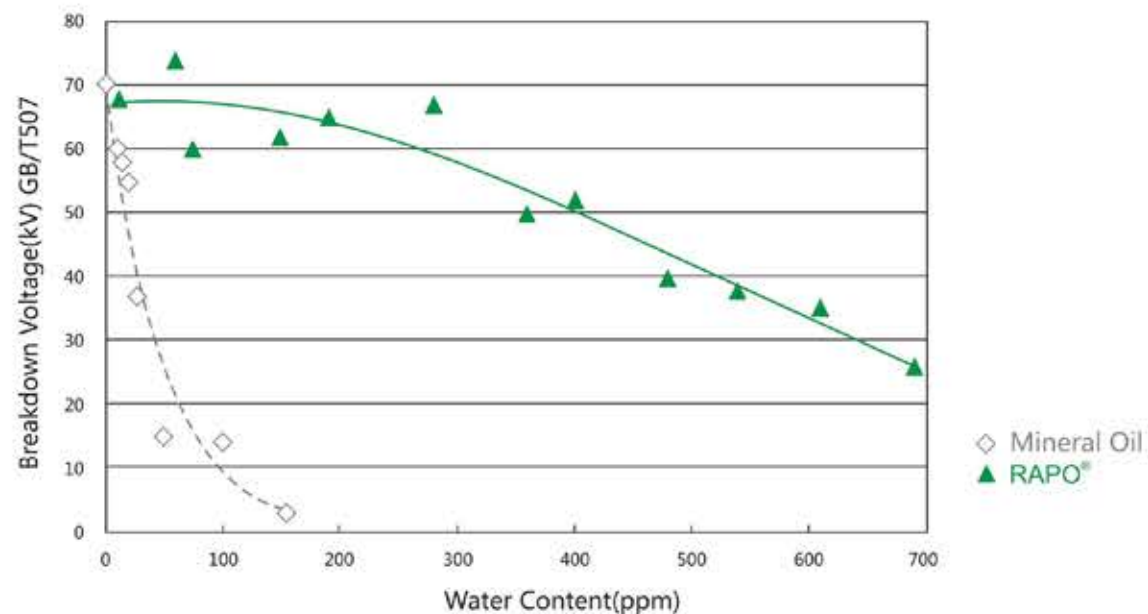


- RAPO® vegetable insulating oil can effectively save equipment maintenance, replacement and other costs, and avoid the economic losses caused by the transformer fire.
- RAPO® can be used indoors or in the compact space.
- RAPO® can help to reduce the use of fire-fighting equipment (sprinkler) and firewalls if space is limited.
- RAPO® can reduce insurance costs.

Excellent Electrical Character

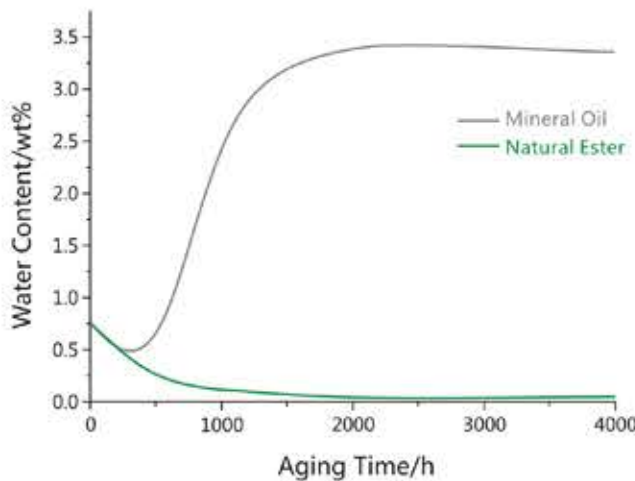
RAPO® vegetable insulating oil has a higher breakdown voltage than mineral insulating oil.

	Dielectric Breakdown (kV)	Standards Request (kV)
RAPO® Vegetable Insulating Oil	72	≥35
Mineral Oil (typical)	65	≥30

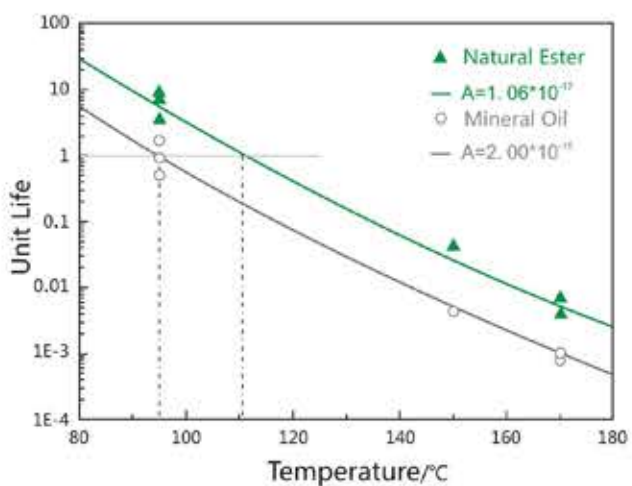
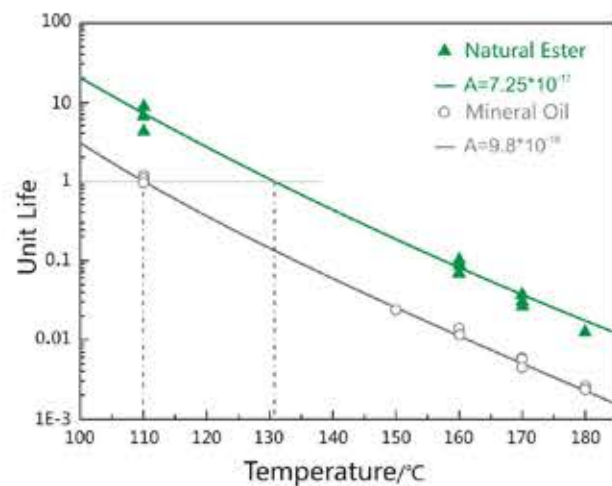


Ester chain in natural ester can make it have "polar" region, the region covered by ester chain effects like a magnetic fields which has a special attraction to water molecule and can absorb the water which exists in insulation cellulose paper material. So RAPO® has extremely high water saturation at various temperatures compared to mineral oil. Under normal operating environment, water saturation of RAPO® is 5-8 times than mineral oil.

Due to the higher water saturation of RAPO®, RAPO® vegetable insulating oil can keep the breakdown voltage to be over 60kV even if the water content exceeds over 300ppm. In contrast, the breakdown voltage decreases dramatically under 35kV when mineral oil contains a little amount of water such as 55ppm.



During thermal aging, RAPO® can absorb the water in insulation paper or pressboard which can accelerate the aging progress of insulation paper and pressboard. So RAPO® can prolong the insulation paper and pressboard aging process and improve the life span of the transformer.



Experimental data shows that insulation paper infiltrated by RAPO® can work with a long time in the environment whose temperature is 10-15°C higher than the maximum allowable one and has same life expectancy with the insulation paper infiltrated by mineral oil, can well prevent the production of precipitates, so that can increase the overload of the transformers. Transformers using RAPO® as filled oil can work in a long term with up to 120% load conditions and without affecting transformer's life and performance.

Insulating Oil Type	Top Liquid Temperature Rise	Average Winding Temperature Rise	Hottest Spot Temperature
Mineral Oil	60°C	65°C	78°C
RAPO® Vegetable Insulating Oil	80°C	115°C	160°C



RAPO® VEGETABLE INSULATING OIL
PARAMETERS

Test Items		RAPO® Insulating Oil	Test Methods	ASTM D6871
Electrical Properties				
Breakdown voltage (kV/2.5mm)		72	IEC 156	≥35
Dissipation factor (%)	25°C	0.06	ASTM D924	≤0.2
	100°C	1.37	ASTM D924	≤4
Volume resistivity (Ω•cm @25°C)		6.9×10 ¹³	DL/T 421	—
Physical and Chemical Properties				
Relative density (g•cm ⁻³ @15°C)		0.919	ASTM D1298	≤0.96
Color		1.0.5	ASTM D1500	≤1.0
Total acid number (mgKOH/g)		0.024	ASTM D974	≤0.06
Viscosity(mm ² /s)	40°C	36.07	GB/T 265	≤50
	100°C	8.263	GB/T 265	≤15
Thermal Properties				
Flash point(open cup)/°C		322	GB/T 3536	≥275
Fire point/°C		357	GB/T 3536	≥300
Pour point/°C		-27	GB/T 3535	≤-10

Energy saving
environmental protection
for a better world

