Why you need to beware of Varnish?

How Varnish Will Affect Your Equipment

In the previous newsletter about Varnish, we already talked about how varnish is generated in your oil and how to detect it. Now, we are going to talk about how the varnish that already detected inside your lube oil is going to affect the performance of your equipment and lube oil.

Varnish generated in oil can be in two states, soluble or insoluble state. Soluble state of varnish is varnish that dissolved in oil and insoluble varnish is a soft particle that precipitate because the amount of varnish inside the oil is already above the saturation limit. Varnish saturation limit of oil widely ranged depends on the base oil, but constantly correlated to temperature and pressure.

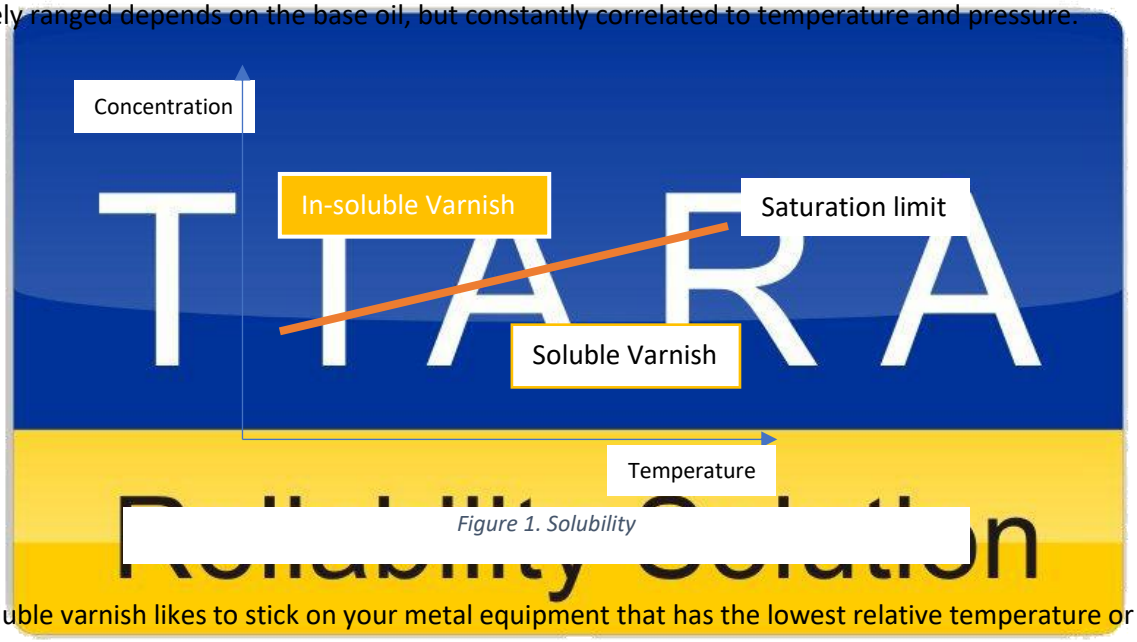
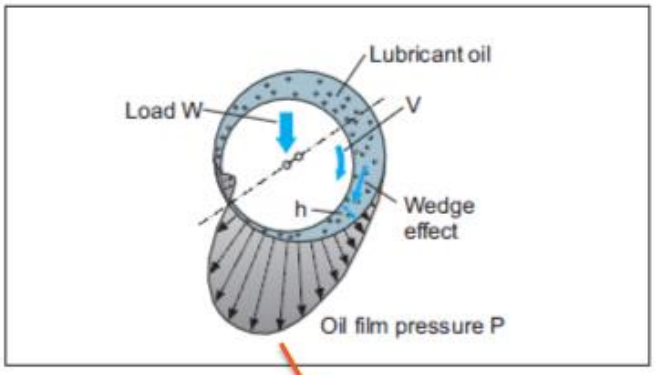


Figure 1. Solubility

Insoluble varnish likes to stick on your metal equipment that has the lowest relative temperature or high-pressure zone. The easiest way to observe this varnish build up on your system is by observing the lube oil tank. Right on the lube oil level line which has the lowest temperature in your system oil tank, you can observe a yellowish stain. This is what insoluble varnish built up looks like. Any other low lube oil temperature position on your system can cause a varnish built up, like oil cooler that can cause the tube to clogged up and disrupt the lube oil flow to bearings, hydraulics, etc. As can be seen in figure 1, the lower the temperature, the saturation limit became lower, so any varnish above that limit will be precipitated into insoluble state.

High-pressure zones also can force the soluble varnish to precipitate into insoluble varnish. This phenomenon might cause the highest damage to your equipment. Most of the high-pressure zone in the equipment is on the lubrication zone, this means varnish built up will disturb the lubrication film. In some cases on journal bearings (figure 2), it causes metal to metal contact between bearing and shaft. On gearbox cases, the gear teeth fractured because of lack of lubrication. High-pressure zone also occurs in filters that can cause filter plugging and also in hydraulic's servo valve that can cause silting.



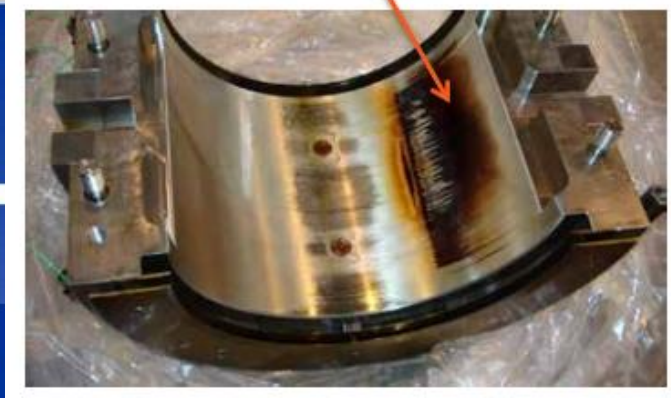


Figure 2. Varnish build up high-pressure condition. Source: Fluitec

This examples just only a fraction of problems that caused by varnish built up in your system. Letting insoluble varnish build up in your system can have a catastrophic impaction your equipment that can lower equipment's reliability. For this reason, you need to make varnish monitoring as a part of your routine lube oil analysis.

How Varnish Will Affect Your Oil

When you have high MPC value, that means your system most likely to have insoluble varnish built up and because varnish is a byproduct of lube oil degradation it means you might have a low antioxidant level or even have none left at all (you can do RULER and RPVOT test to confirm this condition, figure 3). With this data, you might have to change the oil, but it is not just as simple as changing the lube oil.

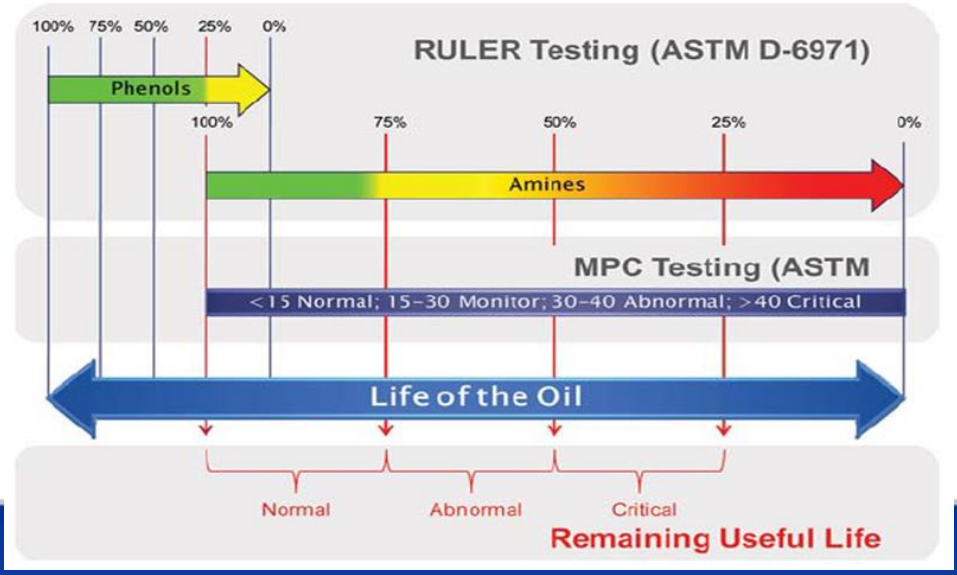


Figure 3. RULER and MPC correlation. Source: Fluitec

When you have insoluble varnish built up on your system, changing lube oil without cleaning the system first will have a big impact on your new oil. Your fresh new oil does not have varnish in it, so when the unit starts to operate and the lube oil temperature rises to its operating temperature, it will dissolve the insoluble varnish on the system back to soluble state. Is this a good thing? No, because the varnish will start to eat away your fresh antioxidant additives. Some case studies show that your new oil life expectancy will drop by half or more than the previous lube oil. If you are not aware of this condition and run the lube oil as long as the previous lube oil, in the end, you will have more varnish built up in your system and this vicious cycle will continue on until the system fail because of varnish.

So, it is very important to start adding varnish potential detection and RULER test in your lube oil analysis program, without having good data trends, we can not plan the correct action to mitigate varnish problem.