FEEDERS

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Are Your Conveyor Belts as Resistant to Oil as They Should Be?

A surprisingly high proportion of bulk cargoes contain various forms of oils, resins, and greases, which have an often seriously underestimated detrimental effect on the performance and life expectancy of rubber conveyor belts.

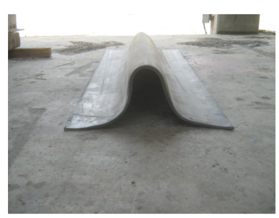
Many millions are spent each year buying, fitting, repairing, and replacing conveyor belts, much of which is inadvertently wasted simply because the conveyor belts being supplied are not nearly as resistant to oil as they should be. Here, Rob van Oijen, head of application engineering at Netherlands-based Dunlop Conveyor Belting, explains how oil damages conveyor belts, the misinformation and misconceptions surrounding test methods and how such damage (and therefore waste) is entirely preventable.

The effects of oil on rubber

There are two distinct sources of oils, resins, fats and greases that damage both man-made and natural rubber. Vegetable oil is the most predominate source in bulk cargo materials and is defined as all forms of oil (and resin) that is derived from flora and fauna. The other primary source is mineral oil, which is usually a liquid by-product of refining crude oil to make gasoline and other petroleum products. Mineral oil is composed mainly of alkanes and cycloalkanes, which are related to petroleum. It is important to bear in mind at this stage that there can be a marked difference in the swelling caused by different oils and resins on rubber compounds.

When oil of any kind penetrates the rubber covers of a conveyor belt it causes the rubber to soften, swell and distort. Although this is often a fairly gradual process, it leads to all kinds of serious problems.

> The first is a dramatic decrease in the ability of the rubber to withstand abrasive wear. As the rubber continues to soften it also steadily loses its tensile strength while at the same time becoming much more prone to ripping and tearing. The next stage is that the rubber begins to swell and distort. This causes steering and handling problems along with a serious reduction in the elongation at break (the amount of stretch before the belt snaps).



Resistance to oils and resins

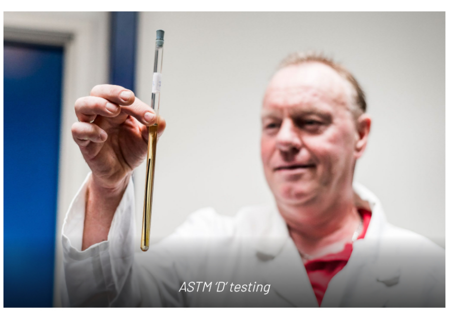
Biomass, especially the wood and wood waste content, can contain vegetable oils and resins that can have a very detrimental effect on the performance and life expectancy of a conveyor belt. Similarly, many fertilizer materials that do not contain oil such as phosphates and urea, are often treated with an oil-based coating to prevent the granules from sticking together.

Some fertlizers are treated with an oil-based coating to prevent the granules sticking together.

The level of oil and resin present in wood depends very much on the type (origin) of the material being handled. For most wood from Scandinavia for example, good resistance to oil is necessary as these trees are mostly pine trees, which have high turpentine content. In South-European countries and in Latin America, Eucalyptus trees are commonly used. The wood from these trees contains little or no turpentine so oil resistance is not so essential. This is generally valid for non-pine wood such as poplar and birch. If the origin of the wood used for the biomass is from variable (or undeclared) sources then only belts made with a good level of oil-resistant rubber should be considered.

Oil resistance test methods

There are two recognized test methods, both of which involve almost identical test procedures and manufacturers are at liberty to use whichever test conditions they deem most suitable to them. The two test methods are ISO 1817 and the comparable, slightly less elaborate but very stringent American ASTM 'D' 1460, which is the test method that we use in Dunlop. In the test, samples of rubber (eg. 100mm X 1.6mm X 2mm strips for the ASTM test) are fully immersed in the relevant test liquid for a specific period of time. The temperature at which the liquid and sample are kept can be varied but the most common is either 3 or 7 days at ambient or 70°C. The ambient temperature of the environment is controlled within specific guidelines. Changes in the geometry and dimensions of the specimen caused by absorption are then measured when the samples are removed.



ASTM 'D' testing

Oil causes rubber to swell

Rather surprisingly, ISO or DIN international performance standards for oil & grease resistance do not yet exist. Unfortunately for end-users, this means that in the absence of actual performance standards, manufacturers and traders can safely claim that the belt they are supplying is sufficiently oil-resistant for its intended use. My best advice is to always ask for precise details of the oil resistance test methods the manufacturer has used to support their claim. However, there is a sting in the tail concerning the matter of test methods.

DIN 22102 G. Not what it seems.

Some of the biggest manufacturers of belting in the world, primarily those in Asia and Europe, use the DIN reference number 22102 G when referring to oil-resistant belting. This can be very misleading because the fact is that there are no firm requirements, test methods, or limits specific to oil resistant belting associated with DIN 22102 G. The letter 'G' is simply used to denote oil (or grease) resistant belting and is NOT an indication of the actual resistance level. This is a classic example of how simply indicating a test method reference number on the supporting technical datasheet is designed to give the end-user a false sense of security even though, in truth, it is meaningless in respect to actual performance.

One type does not suit all

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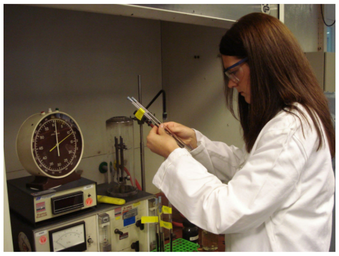

As I mentioned earlier, there are two distinct sources of oils that damage rubber – mineral and vegetable/animal. Despite the fact that each has its own particular effects, most conveyor belt manufacturers only offer one oil-resistant rubber cover quality compound. This is often referred to as 'MOR' (medium oil resistance). In my experience and that of my colleagues in Dunlop, to provide the best possible protection against the differing effects of each category requires at least two oil-resistant rubber compounds rather than a single 'one compound suits all' approach.

Vegetable oils and resins

Most modern-day conveyor belts are made of synthetic rubber rather than natural rubber. This is because natural rubber is not only appreciably more expensive, it is also much less adaptable compared to synthetic rubber. The first and most commonly used is a synthetic rubber compound based on a combination of SBR (Styrene Butadiene Rubber) and NBR (Nitrile butadiene rubber). **Dunlop ROM** is a compound that has been specifically engineered and developed to resist the effects of vegetable-based oils and resins, as well as animal fats and greases.

A good quality SBR should have excellent resistance to abrasion combined with very good tensile strength. Those two characteristics help to ensure that the rubber is durable and long-lasting. This polymer is better than natural rubber when it comes to aging and is better able to cope with a mixture of demands. SBR also has excellent mechanical properties such as particularly good resistance to abrasive wear.

Mineral oils

Compared to most vegetable oils, mineral oils tend to be much more aggressive. For this reason, our engineers developed the extremely successful **Dunlop ROS** rubber compound, which is a Nitrile butadiene rubber (NBR) based synthetic rubber. Although nitrile butadiene is a more expensive compound than Styrene Butadiene, it does provide the very necessary high level of resistance against the damaging effects of mineral oils. Dunlop ROS has a particularly high content of nitrile because the more nitrile there is within the polymer, the higher the resistance there will be to both oil and other aggressive chemical elements such as sodium hydroxide and potassium hydroxide as well as petroleum fuels. At Dunlop, we also recommend the use of the ROS compound for applications where there are particularly high concentrations of animal and vegetable oils.

For the more scientifically minded among you, nitrile butadiene rubber is a family of unsaturated copolymers of 2-propenenitrile and various butadiene monomers (1,2-butadiene and 1,3-butadiene). Although its physical and chemical properties vary depending on the polymer's composition of nitrile, this form of synthetic rubber is unusual in that it is generally resistant to oil, fuel, and other chemicals. The potential danger of having high levels of nitrile within the polymer is that it can reduce the flexibility of the rubber. This means that the recipe formula for a nitrile-based rubber compound has to be extremely precise. Every new batch produced during the mixing process has to be absolutely consistent. That means creating fresh, new compounds for every production run, which is why we mix all of our rubber compounds ourselves rather than using outside sources. Quality control begins at home!

Every batch of rubber compound must be absolutely consistent. Quality control begins at home!

Fire and oil resistant belting

Conveyor belts that are resistant to both oil and fire are increasingly in demand, especially when you consider the highly flammable nature of biomass. Conveyors carry a fire very quickly. A good quality fire-resistant (self-extinguishing) conveyor belt that resists oil at the same time is essential and, of course, much appreciated by the insurers in the form of lower premiums. The basic specification needed is for the belt to be fire-resistant as per EN 12882 2A, ISO 340-K, anti-static as per

ISO 284, and resistant to vegetable oils **(Dunlop BVROM K)** or the mineral oil equivalent, which is **Dunlop BVROS K.**

Longer belt life = lower belting costs

As often as not, the quality of a belt (including its ability to resist oil) is reflected in its price. However, the actual cost of a conveyor belt can only be truly measured over its operating lifetime. It is always worth the effort to check the original manufacturer's specifications very carefully. Always demand a fully detailed manufacturer's technical datasheet and a warranty certificate as well as documented evidence of tested performance *before* placing your order. Doing so could save you from making a very expensive mistake.

Rob van Oijen

ABOUT THE AUTHOR. Rob van Oijen is Manager Application Engineering for Dunlop Conveyor Belting in The Netherlands is one of the most highly respected application engineers in the industry. He has specialized in conveyors for over 14 years, supporting businesses throughout Europe, Africa, the Middle East, and South America.

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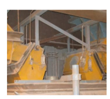

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