Measuring environmental impact: BOD and COD of heat transfer fluids

While most companies are conscious of the impact of their operations and products on the environment, there is always a possibility of leakages or waste liquids coming into contact with water courses nearby. The key is to ensure these fluids have as little impact as possible when that situation occurs, either as part of a controlled, permitted discharge or by minimizing the risk of any accidental release. Wastewater should not be discharged deliberately without first seeking consent or an environmental permit and these safeguards are in place to prevent harmful materials entering into, and adversely affecting, the receiving waters. A number of tests are available to measure the potential impact of discharges into receiving waters, including the BOD and COD values.

BOD: Biochemical Oxygen Demand

BOD is the Biochemical Oxygen Demand – put simply, this means the amount of oxygen which is needed to decompose organic matter in a body of water by bacterial degradation. The more oxygen used during decomposition (for example, in sewage or heavily polluted water), the less is available for fish and other aquatic life. This may lead to oxygen starvation of the water course and the various aquatic species. Hence, wastewater is often treated before being discharged, in part to lower the BOD, which is dependent on the consents and permits in place and the capability of the site. These consents vary from location to location due to a variety of factors including population density, the quantity of waste, and the nature of the site. Testing the BOD value of a water sample takes five days and uses the introduction of certain specified bacteria to represent what would happen in nature.

COD: Chemical Oxygen Demand

COD is the Chemical Oxygen Demand, a measure of how much oxygen would be needed to completely oxidise the carbon in a sample. A strong chemical agent is introduced into the sample for the COD test, which takes two or three hours. The strong oxidising effect of the reagents in the COD test gives a more complete conversion of the substance tested and can be thought of as a maximum amount of required oxygen for chemical conversion. The BOD test, however, gives an idea of how much oxygen would be required under normal biochemical (bacteriological) conditions.

Hence using the two measures gives:

BOD: how much oxygen is likely to be needed by bacterial decomposition of a substance in the environment.
COD: the maximum amount of oxygen required for full chemical degradation of the substance, usually higher than BOD.

Using BOD and COD Measurements

BOD results on a sample will indicate how many milligrams of oxygen are being consumed within each litre of sample water in the environment. If this value is too high, then there is a danger that the fish within the water source will not have sufficient oxygen to survive. If both the BOD and COD results are too high (accepted levels vary from country to country and region to region), this can indicate more serious pollution within a body of water. Depending on what has caused this pollution, there could be a very real risk to other animals and potentially humans too.

Minimizing BOD and COD impacts

Consents and environmental permits given to companies in relation to their waste discharge processes will typically outline BOD and COD limits and any other routine testing requirements, giving consideration to a number of factors, such as the location of the area and the population size. Any business with an environmental permit (including breweries and food/milk processors) must comply with the limits set down within that permit. If a limit is likely to be exceeded, then this must be reported to the appropriate Environment Agency, and the discharge not made. Using process materials which have a lower BOD and COD level can mean that consents are easier to obtain, and further treatment of waste may not be required (which reduces the associated costs and infrastructure needs).

BOD / COD of traditional glycol-based heat transfer fluids and Kilfrost GEO

Traditional glycol- and ethanol-based heat transfer products are biodegradable by more than 97% in under five days. This ready biodegradability at the same time can lead to a high oxygen demand and therefore a high rate of BOD. This means that they are likely to have adverse impacts if released untreated into the environment. In contrast, some newer products feature more attractive BOD / COD profiles. Kilfrost GEO is a low viscosity heat transfer fluid, used in closed loop ground and water source heat pumps, is rapidly biodegradable, and the BOD and COD test results for Kilfrost GEO are significant lower (up to 80% lower in some tests) than traditional glycols. While any unintentional or untreated leakage of the product into the environment may still need to be reported to an Environment Agency, the impact based on lower BOD and COD values would be greatly reduced compared to that of traditional glycols.

Table: Comparison of BOD and COD results for traditional fluids and Kilfrost GEO

Results in mg/L	Ethylene Glycol	Propylene Glycol	Ethanol	Kilfrost GEO
BOD5 test results	700,000	1,360,000	1,250,000	250,000
COD1 test results	1,290,000	1,560,000	2,080,000	670,000

Kilfrost GEO:

Kilfrost GEO is an advanced heat transfer fluid that has been specifically engineered to improve the performance of closed loop ground and water source pumps.

As a non-toxic alternative to mono ethylene glycol (MEG), it offers first-of-a-kind protection that delivers an immediate increase in pumping and heat transfer efficiency – leading to significant long-term energy savings.

As well as offering superior performance, the product has unrivalled environmental credentials. It is classified as non-hazardous by CLP/REACH and is free from nitrates, nitrites, borates, heavy metals and phosphates.

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