Green Indicator

In this issue we will discuss the pros and cons of traitional catalysis versus biotechnology based catalysis e.g. bugs. Is one better than the other or could we use them together in a combination to improve some aspects of the technology. In the main article we will focus on what makes the wheels go round and why we shouldn't underestimate the versatility of biobased lubricants. Decoupling the lubricants from the oil pricing as well as having a multitude of sources from which they derive.

/Andreas Leveau

Biobased Lubricants – The Next Step Towards a Greener Industry

Renewable feedstock and the reduction of CO2 emission are both playing a big role when discussing ways to increase industrial sustainability. But when putting so much focus on what goes into our processes and what comes out on the other side, it is often easy to forget the things that literally helps the wheels of the machinery to turn. It is time to bring forth the biobased lubricants.

Only a small fraction of today's global lubricant market consist of biobased lubricants, estimations vary from less than 1% up to 5%, but the demand seems to be growing with 5-10% / year. In addition to agribusiness such as Cargill, LubriGreen BioSynthetics and Performance Bioilubes, biotech start-up companies such as Elevance Renewable Science, Amyris and Solazyme have entered the market with fermentation based processes.

Green Indicator #22, November 2012

Traditional Catalysis vs. Bugs

There is much debate regarding the benefits and drawbacks with using traditional reaction engineering and catalysis and using catalysis in the form of biotechnology, also called white biotechnology in its industrial form. In short the arguments from the traditional catalysis side are that the reaction rate is very much higher at elevated temperatures and that the bugs used to smell bad. The main argument from the biotechnology people is that their selectivity is outstanding and that it uses feedstocks other than petroleum-based. There is however one inherent difference and that is the scale of operation. There are significant economies-of-scale using traditional catalysis operation and therefore the production units are quite large. The lower reaction rate and the difference in feedstock will make large-scale operation of biotechnology plants difficult due to logistics and reactor vessel sizes.

But does it have to be either/or?

It should be possible to use the one in combination with the other to improve some aspects of the technology. To

one might assume, the strive for increased sustainability. In fact both vegetable-derived and biosynthetic based oils have certain advantages over their petroleum counterparts in different applications. Apart from being nontoxic and biodegradable, the oils can be imparted with certain performance characteristics and tailored to meet the special needs of different consumers. This is done by controlling chain lengths, saturation level and functional group additions and also through hydrogenation, oxidation, polymerization, amidation and esterification. By combining different modifications it is possible to obtain oils that better withstand severe operating conditions, contaminants and that have good oxidative and thermal stability. Another advantage with biobased lubricants is that they do not rely on a single source of supply, and more importantly, they are disconnected from petroleum pricing.

catalysis where effluents are treated using microbes, e.g. in wastewater treatment or biologic desulphurization. A key future development in this area would be to not view the effluent as something to dispose of, but as a feedstock for producing products. The problem will then be reduced to a separations issue as these streams by nature are quite diluted, this should therefore be a focal point of future research. Speaking of separation, this is an area where biotechnology might be able to work with traditional catalysis to lower the energy required for separation as well as improve the product quality of the product. One such example would be to catalytically transform bioethanol into a hydrocarbon, this hydrocarbon would then be more suitable as a drop-in vehicle fuel and due to the low solubility of oil in water separation should be easier as well.

Authors:
Christian Hulteberg,
christian@hulteberg.com
+46 733 969420 and
Laura Malek,
laura.malek@chemeng.lth.se

Editor:
Andreas Leveau,
andreas@hulteberg.com
+46 733 969423