

## Testing Times

There is a debate between the lubricants industry and legislators about the safety of mineral oil saturated hydrocarbons and mineral oil aromatic hydrocarbons, known as MOSH and MOAH. These groups of carbon and hydrogen atoms are found almost everywhere in the food-processing chain, not only in oil but also packaging and the food itself.

Very highly refined mineral oils, like those used in food-grade lubricants, consist almost entirely of MOSH with very small amounts of MOAH. MOSH were suspected by food safety agencies to cause liver damage, while certain MOAH fractions are potentially carcinogenic.

The European Petroleum Refiners Association's research group, Concawe, has presented a large body of evidence to European food safety authorities that food-grade lubricants are not a serious threat to human health, based on years of laboratory testing.

Juan Carlos Carrillo, toxicologist for Shell International and Concawe, explained how these molecules are detected and what their effects are at the ICIS and ELGI Industrial Base Oils conference in Amsterdam this June.

"We need to go into some basic concepts," said Carrillo. "MOSH is nothing else than a chromatography measurement. It doesn't say anything about toxicity. It doesn't say anything about origin." This is also true of MOAH. A chromatograph is an analytical tool that separates chemical substances into their components.

Proving the detrimental health effects, or other effects, of MOSH has been challenging. Previous toxicological data were acquired using a Fischer 344 rat, a strain commonly used by U.S. toxicologists. After comparing the effects of oil consumption in the livers of these rats and humans, researchers realized they were not analogous.

"Humans don't develop the same type of adverse reaction. It just sits there but it doesn't do anything," Carrillo said. Yet the European Food Standards Agency used the Fischer rat data as the basis of a 2012 scientific opinion that informed policy.

Even extreme consumption of mineral oil (in one case, as a laxative) does not produce the same disease in humans as seen in Fischer rats, Carrillo said. "If you are exposed through normal means via food contact materials, you would never see something like that," he pointed out. Further research on different rat strains confirmed their findings.

MOAH refers to the aromatic content of an oil. "It is not an actual substance which you put on the market," Carrillo said. Aromatics contain unsaturated carbon rings, and the carcinogenicity of MOAH depends on the concentration of particular polycyclic aromatic compounds.

Toxicologists paint a small amount of the test material onto the shaven skin of mice that are highly sensitive to carcinogens several times a week for two years. The mice are then examined

for tumors and compared to a control group. Using different fractions of oil and control groups, toxicologists found that MOAH with three or more aromatic rings may be carcinogenic.

"The mouse test is the gold standard for carcinogenicity. It has always been so, and it is a pass-fail test. Either you are carcinogenic or you are not carcinogenic. You are not in between," said Carrillo.

Even though these MOAH should have been removed during the refining process, refining companies cannot wait two years for mouse-test results. What is needed is a faster test backed up by the mouse data.

A chemical test to detect those species in oil is available – the industry standard IP346, which uses a solvent to latch onto the harmful, "naked" polycyclic aromatic compounds, leaving behind species that have two rings or less and/or are highly alkylated, and therefore harmless, after the solvent is extracted.

From the 133 two-year mouse test data points and the efficacy of IP346, "there is no other chemical that has so much carcinogenicity data as mineral oil. What you have here is 266 years of data, and it is the only validated analytical method. Forget about your MOSH/MOAH measurements by chromatography. This is the real McCoy," said Carrillo.

Now that the easy chemistry and toxicology business is out of the way, then comes the hard part – communicating these findings to the authorities so they can make appropriate policies. □