China

Business – There are currently about 100 chlorinated paraffin (CP) producers in China. Chinese CP production capacity has been increasing year on year and in 2013 the production capacity reached 1,600,000 tonnes/year, an increase of 14.3% compared to 2012. Growth in demand for CPs is slower compared to the increase in production capacity and as a result, producers operated their units at 70% capacity in 2013. Total CP production for 2013 reached 1,050,000 tonnes. CP capacity is mainly concentrated in the Henan, Jiangsu, Shandong, Hebei and Zhejiang Provinces.

Currently under the 12th Five-Year Guideline, the Chinese CP industry is defined by the following features: firstly, the individual plant capacity has increased in line with the annual increase in total production capacity; secondly, market competition has intensified due to the overcapacity situation; thirdly, product development using CPs is becoming more diverse.

Japan

Business - SCCP is no longer manufactured in Japan, while production of MCCP and LCCP continues.

Regulatory – C11 chlorinated alkanes with 7 to 12 chlorine atoms are listed in the “Monitoring Chemical Substances” list under the Chemical Substance Control Law, while C10-13 chlorinated alkanes are listed under the Pollutant Release and Transfer Register Law. Under both these regulations, manufacturers or importers are required to report to the government on products containing more than 1 wt% of the concerned substance.

Europe

Business - Although MCCP and LCCP production continues, SCCPs are no longer permitted for sale or manufacture in the EU. Total demand is well below historic levels, partly due to the increasing regulation and partly due to the economic recession. Growth in the region continues to be weak, with quarter-on-quarter performance for Q2 grinding to a halt due to Germany shrinking by 0.2% due to a weak construction industry, the French economy stagnating and Italy slipping back into recession.

Regulatory – Following the evaluation of MCCP REACH dossier, the European Chemicals Agency (ECHA) issued a decision requiring new persistence and bioaccumulation testing of specific MCCP components. The MCCP consortium considers this testing to be inappropriate and has lodged an appeal with the ECHA Board of Appeal in order to contest the decision in May 2014. The appeal process is expected to last 9-12 months.

North America

Business – Alkane feedstocks in North America remain tight and costs are increasing. Overall, demand for CP’s in North America remains flat.

Regulatory - Canada is in the process of implementing its prohibition of C10-13 chlorinated alkanes, requiring reporting of any substance, mixture, or preparation manufactured in or imported into Canada that contains more that 0.5% C10-13 chlorinated alkanes. Risk management rules are being developed for C14-20 chlorinated alkanes.

Regulatory - In the United States, the EPA continues to review the premanufacture notices (PMNs) submitted by CP manufacturers and importers for MCCP and LCCP products, while it has already sought the voluntary elimination of SCCP from the U.S. market. To date, two U.S. manufacturers and one importer have submitted PMNs and have been allowed to place their products on market in the U.S. The U.S. EPA is also considering additional testing requirements and use restrictions on MCCP and LCCP products.

Global

Regulatory – SCCPs remain a candidate persistent organic pollutant (POP) on Annex E of the Stockholm Convention and will be addressed again at the POP Review Committee (POPRC) meeting in 2015. In the meantime, the POPRC is collecting relevant information and monitoring data on SCCPs to aid in their evaluation of the risk profile of the substance.

Upcoming events:

ICAIA—The Chinese Chlor-Alkali Industry Association will host the 2nd ICAIA meeting which will be held in China in April 2015.
Medium chain-chlorinated paraffins (C14-17) (MCCP) have been in the regulatory spotlight in the EU for several years. Prompted by concern over their potential persistent, bioaccumulative and toxic (PBT) properties, MCCP was placed on the Community Rolling Action Plan (CoRAP) list in 2012 under the EU REACH Regulation. This triggered an in-depth Substance Evaluation with the aim to clarify whether the substance fulfils the regulatory criteria for classification as a PBT. Throughout this process, new data on biodegradability of MCCP components has been generated, and a thorough weight-of-evidence assessment of the bioaccumulation potential has been carried out using the currently available data. The summary below builds on past knowledge and incorporates these latest findings, and includes a description of the state of the art in CP analysis.

Bioaccumulation
A weight of evidence assessment of the available bioaccumulation data, including laboratory and field data, indicates that, although some MCCP constituents show calculated growth-corrected BCFs that exceed regulatory criteria, they are not likely to biomagnify in fish and aquatic food webs (Thompson et al., 2013). The summary below highlights the key information for MCCP in relation to current regulatory frameworks for assessing bioaccumulation:

Bioconcentration Factors (BCF): The most reliable BCF value for an MCCP component is approximately 1,000 for a C15 51% Cl substance. This falls below the regulatory criterion for bioaccumulation defined in Annex XIII of REACH which has threshold values of 2,000 and 5,000 L/kg for PBT and vB substances, respectively. In one case, a BCF of over 5000 has been found for one MCCP component, a C14 45% Cl substance, this component has also been shown to be readily biodegradable (i.e. not P) so it is not a PBT.

The primary biotransformation rate constant (k0) has been identified as a key determinant for the bioaccumulation assessment of MCCP (Arnot). There is no notable trend in differences in k0 for the range of carbon length and chlorine substitution included in available test data which suggests that additional testing on individual components of MCCP may not provide any “new” information based on the BCF assessment metric.

Biomagnification Factors (BMF) and Trophic Magnification Factors (TMF): Measured laboratory and field BMF values for MCCP range from 0.1-0.96 and all available TMF values for MCCP are also <1 (a value of >1 is indicative of bioaccumulation). The current weight of evidence indicates that expected MCCP constituents are not likely to biomagnify in fish or in aquatic food webs based on laboratory and field biomagnification factors (BMFs) and field trophic magnification factors (TMFs), respectively.

Persistence
The current best available insight in the biodegradation characteristics of commercial MCCP is summarized below, based on a combination of past knowledge and three more recent studies. A tetradecane was chlorinated at 5 different levels (40, 45, 50, 55 and 60 wt% chlorine) and subjected to adapted closed bottle tests, and sequencing batch reactor (SBR) studies. The SBR studies aimed to establish a mass balance in order to quantify the extent of overall biodegradation, using chloride analysis in a totally chloride-free test medium. The results can be summarised as follows:

- Chlorinated alkanes are far better degradable than previously thought; polychlorinated C14 alkanes with up to 50% chlorine even satisfied the criterion for classification as ‘readily biodegradable’ (>60% biodegraded after 28 days). Higher chlorinated tetradecanes did not reach the 60% biodegradation level but showed some significant oxygen consumption. This indicates that partial biodegradation of components occurred, although full mineralization of all components was clearly not achieved.

- Biodegradability decreases with increasing chlorination level, i.e. less densely chlorinated alkanes (and segments of alkane chains) are biodegraded more easily than densely chlorinated (parts of) alkanes. An overall “readily biodegradable” result indicates that the densely chlorinated recalcitrant fraction is very minor or negligible.

- Sequencing batch reactor studies using CI as a tracer confirmed that higher chlorinated alkanes have larger fractions of the more recalcitrant parts of the component molecules. The 40% chlorinated C14 alkane was almost completely mineralized, the 50% chlorinated C14 alkane reached 60% mineralization and the 60% chlorinated C14 alkanes reached about 10% mineralization.

- Analytical studies were carried out to understand the composition of chemicals in relation to the biodegradation results. An apparent increase in the relative fraction of higher Cl components in the samples after biodegradation confirm that more densely chlorinated sections of the alkanes are recalcitrant to biodegradation.

Analysis of CPs
The state-of-the-art for CP analysis is the use of comprehensive 2-D gas chromatography (GCxGC) with electron capture detection (ECD), while the most commonly used technique is GC combined with electron capture negative ion mass spectrometry (ECNI-MS). Currently, qualitative separation of groups of CP isomers by carbon chain length and chlorination level is possible using the above techniques, although this is still difficult due to the complex nature of the substance. Chlorination level and substitution patterns are known to affect detector response and complicate CP analysis. At present, available individual congener standards used for detector calibration do not match congeners found in commercial products and as such are not suitable to allow precise quantification of individual CP components.