pinfa
Phosphorus, Inorganic & Nitrogen Flame Retardants Association

Your newsletter for non-halogen fire safety solutions
No. 99 February 2019

4th Fire-Retardant Plastics Conference 1
Workshop on design for fire safety in green electronics 1
SPE Non Halogen session at ANTEC 2019 1
FSEU webinar on fire safety data 1
Call for papers: Innovative flame Retardants 2
Public consultation on EU Ecolabel 2
UK consultation on building fire safety regulations 2
EU FIEP (Fire Information Exchange Platform) 3
A car seat meets the chemical of her dreams 3
Compounding World innovations in PIN FRs 3
Fire Standards Coalition launched 4
EU launches plastics recycling platform 4
Zinc oxide as flame retardant for polypropylene 4
Studies detect phosphorus PIN FRs 5
Kingfisher to exclude halogenated FRs 6
Smoke emission / heat release ratio with / without FRs 6
pinfa promotes PIN FR recycling at IERC 7
Trends in science concerning consumer chemicals 7
AEI offers new cable performance for fire safety 7
Review of impacts of FRs on plastics recycling 8
Regulatory pressure tightens on antimony (ATO) 8
P-functionalised chitin as waste-sourced PIN FR 9
FireSafetyTools informs on codes and regulations 9

4th Fire-Retardant Plastics Conference

Organised by AIMPLAS and pinfa in **Valencia, Spain, 4th April,** this workshop will bring together the flame retardant industry, compounders and researchers to look at perspectives for flame retardant plastics. Themes will include bio-based flame retardants, recycling of PIN FR plastics (with recycling professionals and Plastics Europe) and future perspectives including e-mobility, 3D-printing and new fibres.

Programme and registration: http://www.plastics-training.aimplas.net/PFSeccion.aspx?s=workshops-and-seminars&idconvocatoria=9205

Workshop on design for fire safety in green electronics

San José, California, **30th April – 1st May 2019**. Day 1 will provide an overview of flame retardants, fire testing and formulation for electrical and electronic applications, with presentations by Alex Morgan (UDRI), testing and standards organisations and compounders. Day 2 will discuss emerging flame retardant needs for green materials for electronics applications, resulting from developments in performance and fire testing requirements and sustainability specifications, with OEM and component manufacturer perspectives.

www.pinfa-na.org Abstract submission: rweiler@amfine.com Info & registration: dwagner@pinfa-na.org

SPE Non Halogen session at ANTEC 2019

Pinfa NA is Co-sponsoring a session at the SPE (Society of Plastics Engineers) Non Halogen Special Interest Group session on **20th March**, 2019 at ANTEC 2019 in Detroit, Michigan. *https://www.4spe.org/files/events/2019/ANTEC/2019ANTECInspireProgram.pdf*

FSEU webinar on fire safety data

Fire Safe Europe (FSEU) webinar **15th March**: "Learning from other EU initiatives which have been collecting data with the aim to increase safety". The objective is discussion between organisations which collect and manage data relevant to improving fire safety, on best practice, data sharing and on developing European standards on fire safety data collection and analysis. With Guy Marlair and Benjamin Truchot, from INERIS (Institut national de l'environnement industriel et des risques, France).

Friday 15 March 14h00-14h30 (CET) https://zoom.us/webinar/register/WN__GXNDg8jS6uezml86hyixQ

pinfa, rue Belliard 40, B-1040 Brussels, Belgium
pinfa@cefic.be Phone +32 2 436 94 51 www.pinfa.org
@pinfa_eu

Responsible Care® OUR COMMITMENT TO SUSTAINABILITY

cefic sector group

Call for papers: Innovative flame Retardants

The Journal Molecules – Materials Chemistry has published a call for papers for a special issue on "Innovative Flame Retardants". Papers should address synthesis, properties and testing of bio-based flame retardants, including life cycle analysis.

Call for papers: deadline 30th September 2019
https://www.mdpi.com/journal/molecules/special_issues/Flame_Retardants

Public consultation on EU Ecolabel

The European Commission opened a public consultation on future orientations for the EU Ecolabel (Flower). The questions were general, including which types of product should be prioritised for the Ecolabel in the future, how to assess success of the Ecolabel scheme and what data on market shares should be collected.

Consultation, closed 3rd March 2019
https://ec.europa.eu/eusurvey/runner/EUEcolabelStrategy2019

UK consultation on building fire safety regulations

The UK Government has launched a public consultation, open to 1st March 2019, on "Document B" (1) of the building regulations. This consultation is a "call for evidence" to inform the review of UK building fire safety, as part of a wider review of fire safety, concerning high rise buildings (following the Hackitt report, see pinfa Newsletter n°92, and the Grenfell Tower fire inquiry) but also "any issues affecting fire safety in all types of building". The consultation does not however concern specific buildings such as hospitals and schools. The UK Government has already announced a ban on the use of combustible materials in external walls of new residential buildings over 18 m high (see pinfa Newsletter n°95). The current online consultation proposes the following areas for consideration, but specifies that other questions can also be submitted: specific challenges of care homes and specialised housing, compartmentation, risk of fire spread between buildings (space separation), trigger building height thresholds for fire safety requirements, means of escape, sprinklers, fire service access, basements, new construction techniques, products and designs, construction industry implementation and quality control, smoke emissions and smoke toxicity. The consultation also raises the question of whether building regulations should target only life safety, or whether they should also address property protection from fire (economic loss).

UK Government public consultation "Technical review of Approved Document B of the building regulations: a call for evidence", open to 1st March 2019
https://www.gov.uk/government/consultations/technical-review-of-approved-document-b-of-the-building-regulations-a-call-for-evidence

(1) "Document B" provides statutory guidance on achieving compliance to paragraphs B1 – B5 of Schedule 1 of the UK Building Regulations 2010.

(2) the UK Government has announced a separate review of Building Bulletin 100 – Design for Fire Safety in Schools BB100, for early 2019.

EU FIEP (Fire Information Exchange Platform)

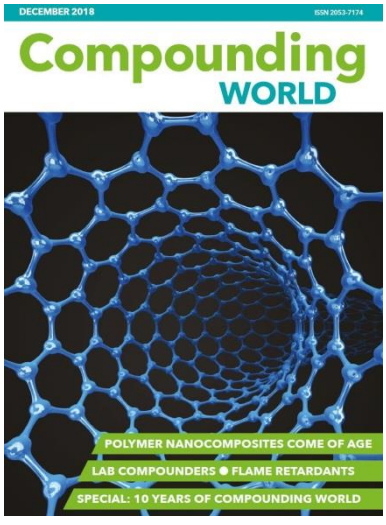
On February 27th 2019, the EU FIEP held its 2nd plenary meeting, bringing together most of the member states representatives, the European Commission, firefighters and stakeholders involved in the 5 project teams identified. The FIEP was launched two years ago, in the aftermath of the Grenfell Tower disaster, to pool knowledge and statistics on fire. Project teams (see pinfa Newsletter n°95) reported on progress and three member states (Sweden, Estonia, Portugal) presented national actions on fire safety. In Estonia, a campaign to promote smoke detectors is estimated to have halved fire-related fatalities. Overall three messages could be taken home: - education is crucial, information is available but needs to be exchanged, firefighters' expertise is instrumental and should be integrated. The provisional results of a survey of Member States on regulation to improve fire safety were also shown, showing a tendency to update national fire safety regulations on a regular basis, (at least, for those MS which replied). Within the European Commission, fire safety issues are spread across more than 10 different units (with GROW C1 coordinating the FIEP, with secretariat contracted to Efectis), in 7 Directorates-General. pinfa and other participants suggested the need to establish coordination.

Interested stakeholders can join the FIEP Project Teams and access documents via by contacting Stephanie Rochon at DG GROW: Stephanie.rochon@ec.europa.eu

A car seat meets the chemical of her dreams

Environmental NGO ChemSec has produced an 2 minute video "When a car seat meets the chemical of her dreams", promoting its online platform MarketPlace (see pinfa Newsletter n°s 97 and 95) for safer alternative chemicals. Entertaining and funny: enjoy!. MarketPlace enables producers of alternative chemicals to publish information, enabling potential user companies to identify substitutes. The video underlines the need for solutions to ensure friendly fire safety of children's car seats, and the relief of finding that your blind date is not PBT.

https://marketplace.chemsec.org/articles/news/2019/01/24/watch-what-happens-when-a-car-seat-meets-the-chemical-of-her-dreams/



Compounding World innovations in PIN FRs

The annual feature article in Compounding World on flame retardants illustrates the industry tendency for new developments, featuring only PIN FR solutions, all non-halogenated. The move away from antimony, because of regulatory concerns, is also emphasised. pinfa is cited as identifying new requirements for fire safety in electric vehicles, with demand for non-halogenated FRs resulting from declaration systems such as IMDS and GADS, and in construction and E&E, with demand for low smoke PIN solutions. All the company products and innovations featured are non-halogen, with: Applied Minerals, Adeka, BYK, Clariant, Europiren, Evonik, Fraunhofer LBF, FRX Polymers, ICL, Kraiburg, Paxymer, Polymer Resources, Quarzwerke, Techmer PM.

Compounding World, December 2018, pp. 41-48 www.compoundingworld.com

Fire Standards Coalition launched

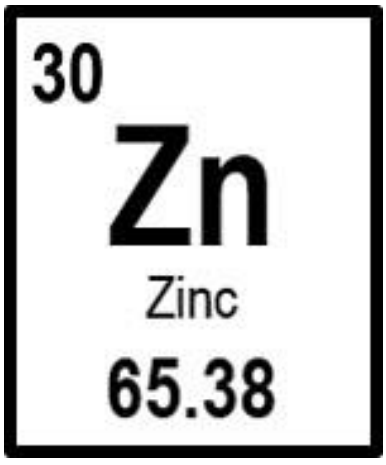
Some 30 different organisations worldwide have jointly launched the "International Fire Safety Standards Coalition" (IFSS Coalition). Member organisations include national and international professional bodies and standard setting organisations, fire protection associations, industry associations and the United Nations (UNECE Committee on Housing and Land Management). The initiative follows from the Grenfell Tower fire, London, and aims to improve fire safety standards in buildings and construction, and their professional implementation, across the world. The Coalition intends to develop high-level international standards, then to support their implementation locally across the world. The Coalition is chaired by Gary Strong of the Royal Institution of Chartered Surveyors (UK).

"UNECE joins global coalition to improve fire safety in buildings through industry standards", 12 July 2018 https://www.unece.org/?id=49147 and "International Fire Safety Standards", Gary Strong, Global Building Standards Director, Royal Institution of Chartered Surveyors, London, 7 September 2018 https://www.rics.org/eu/news-insight/latest-news/news-opinion/international-fire-safety-standards/

EU launches plastics recycling platform

The European Commission has launched the "Circular Plastics Alliance", to bring together industry, retailers and stakeholders from primary materials production, OEMs, packaging, waste collection, recycling and covering sectors such as consumer products, construction, automotive. A first meeting will take place on 5th February at which CEFIC will participate.

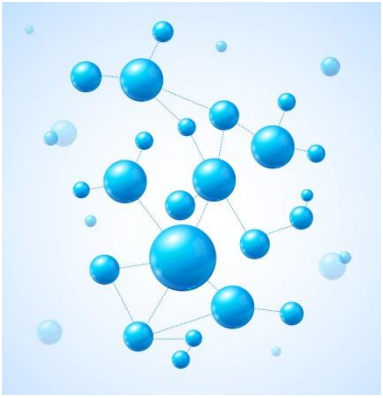
European Commission website for the Circular Plastics Alliance: https://ec.europa.eu/growth/industry/policy/circular-plastics-alliance_en and press release 11 December 2018 "Commission launches Circular Plastics Alliance to foster the market of recycled plastics in Europe", IP18-628 http://europa.eu/rapid/press-release_IP-18-6728_en.htm



Zinc oxide as flame retardant for polypropylene

Zinc oxide (ZnO) has been demonstrated as a PIN flame retardant in a range of materials, including wood, natural fibres and PVA (poly vinyl alcohol) and nano-sized particles of the mineral have shown better dispersion. In this research paper, daisy-shaped zinc oxide nano-wires, diameter 80-120 nm and length 1.5-3 µm, were tested at loadings of 0 – 40 % in polypropylene. A 30% loading of zinc oxide nano-wires reduced peak heat release rate (PHRR) to below 2/3 of the PHRR of neat polypropylene, decreased total heat release rate, increased degradation onset temperature (+34°C), and reduced maximum smoke density (MSD) to below ½ that of neat polypropylene. These results are similar to those achieved with the same loading of non-nano zinc oxide. The authors note that the nano zinc oxide leads to more rapid char formation.

"Enhanced flame retardancy and smoke suppression of polypropylene by incorporating zinc oxide nanowires", J. Guo et al., Journal of Polymer Research (2019) 26:19 https://doi.org/10.1007/s10965-018-1680-6



Studies detect phosphorus PIN FRs

Three studies (two USA, one Canada) published in scientific journals have led to media coverage of presence of phosphorus-based flame retardants in different products. One study reports analysis of textiles from 18 children's car seats (manufactured in the USA, China and Canada) in which two cyclic phosphonates (i), other phosphorus FRs (TDTBPP and RDP (ii)) and the brominated FR DBDPE (iii) were detected at levels indicating deliberate use (PMMMPs 0 – 23 000 µg/g) as well as other brominated FRs at low levels suggesting contamination e.g. from recycled materials. Media coverage states "cyclic phosphonate ester-based FRs found to be toxic" whereas the published article in fact states that no toxicity data is available for these FRs. In another study which has generated media coverage, flame retardants were analysed in wipes applied to hands of 12 employees at the end of their shift in (one) US electronics recycling facility. Five flame retardants were detected in at least one blank wipe, before use. Each worker's hands were wiped three times using different material wipes with alcohol, and the study concludes that a varying proportion of flame retardants were removed with the first wipe, but often over half was removed with the second and third wipe, concluding that one wipe is insufficient to clear flame retardants off hands. The flame retardants found at the highest levels were BDE-209 (DecaBDE), TPHP and TCP (iv). In the third study, phosphorus FRs/plasticisers were compared in urine from 51 Canadian women, in hand wipes, and in in wipes of electronic equipment (handheld phones, computers), household dust and air from their homes. The highest mean levels of analysed P- FR/plasticiser in the E&E wipes and hand wipes were for TBOEP (v), an order of magnitude higher than any other substance. TBOEP was also highest in dust (6 µg/g). However, neither this substance and analysed metabolites showed levels in urine lower than others. TPHP (iv) showed the highest concentrations in air (0.4 ng/m^3) and DPHP (vi) the highest in urine (12 ng/l), possibly as a metabolite of TPHP. Both TBOEP and TPHP are used in other applications, such as polishes or nail varnishes, and the authors conclude that their results are largely not coherent with use of these substances as flame retardants in E&E, suggesting that detection of wipes of E&E equipment may be because these plastic surfaces are accumulating these substances from hands or dust or air.

An aspect of concern in these studies is the tendency to present results as rate of detection (presence above detection limit), ignoring concentration, which means that 'science' results are increasingly driven by detection and sampling methods, and increasingly unrelated to risk assessment.

(i) the two cyclic phosphonates PMMMPs concerned are: 5-ethyl-2-methyl-2-oxido-1,3,2-dioxaphosphinan-5-yl)methyl methyl methylphosphonate and bis[(5-ethyl-2-methyl-1,3,2-dioxaphosphorinan-5-yl)methyl] methyl phosphonate p,p´-dioxide} (ii) TDTBPP = tris(2,4-di-Hi Katie,tbutylphenyl) phosphat; RDP = resorcinol bis(diphenyl phosphate) (iii) DBDPE = decabromodiphenyl ethane (iv) TPHP = triphenyl phosphate; TCP = tricresyl phosphate (v) TBOEP = tris(2-butoxyethyl) phosphate (vi) DPHP = diphenyl phosphate

"Field evaluation of sequential hand wipes for flame retardant exposure in an electronics recycling facility", C. Beaucham et al., Chemosphere 219 (2019) 472e481 https://doi.org/10.1016/j.chemosphere.2018.12.027

"Children's Car Seats Contain Legacy and Novel Flame Retardants", Y. Wu et al., Environ. Sci. Technol. Lett., 2019, 6 (1), pp 14–20, http://dx.doi.org/10.1021/acs.estlett.8b00568

"Are Cell Phones an Indicator of Personal Exposure to Organophosphate Flame Retardants and Plasticizers", C. Yang et al., Environment International, vol. 122, Jan. 2019, pp 104-116 https://doi.org/10.1016/j.envint.2018.10.021

Kingfisher to exclude halogenated FRs

The international home improvement retailer Kingfisher (which includes B&Q, Brico Dépôt and Screwfix) has announced that it will exclude all halogenated flame retardants from all of its own-brand products by 2025, with the objective of extending this to all of its product suppliers. This goes beyond regulatory bans or constraints on certain brominated and chlorinated flame retardants. Ortho-phthalates and perfluorinated chemicals (PFCs) will also be excluded. The company considers this to correspond to sustainable chemicals management and to the objective of staying ahead of regulation.

"Kingfisher pledges to phase out three chemical families from its supply chain", 23 January 2019 https://www.kingfisher.com/index.asp?pageid=55&newsid=1187

Smoke emission / heat release ratio with / without FRs

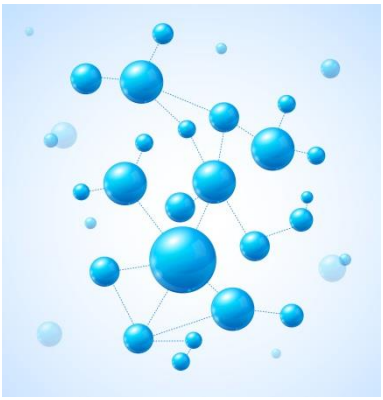
A detailed scientific paper is published by R. Sonnier, H. Vahabi and C. Chivas-Joly, comparing smoke emission and heat release rate for 22 neat polymers (commercially available). and 9 polymer-FR combinations The FR-polymers tested were (1) EVA (ethylene-vinyl acetate copolymer) with 0 - 60% ATH (aluminium trihydroxide) or MDH (magnesium hydroxide), and (2) polyethylene (LDPE) and polypropylene (PP) with zero or 10% of the phosphorus PIN flame retardant DOPO or the brominated flame retardant TBBPA. Each sample was tested duplicate or triplicate, using 2 mm or 4 mm thick 100 x 100 mm surface of material in cone calorimeter. The ratio A [smoke released per energy released] was calculated as the measured smoke release rate / measured heat release rate. Detailed results show that, for each material, this smoke/energy ratio changes over time with the development of the fire. A second parameter was also identified HRR_{th} (or MLR_{th}), that is the "smoke point" or minimum heat release rate below which smoke is not produced, around 100 kW/m^2 for polyolefins, lower for aromatic polymers (can be different between the initial development of the fire and the final dying down). For pure polymers, aromatic polymers emit more smoke and there is a wide variation of A ratios, from below 0.01 (m^2/kJ) for polyamides and PMMA poly(methyl methacrylate) to 0.03-0.05 for SBS, epoxies and polycarbonate. Inclusion of ATH or MDH very considerably reduces smoke emission rate and total smoke emission in EVA (to 1/3rd – 1/5th, taking into account the 'dilution' of the polymer by the filler), but the ratio A suggests that this is due mainly to the reduction in the heat release rate (not to specific smoke suppression). In polyolefins, the flame retardants (TBBPA and DOPO) did not increase significantly the A ratio [smoke release per energy released]. Both FRs decreased the 'smoke point' heat release threshold HRR_{th} significantly. The authors remind that ventilation conditions are a primary factor influencing smoke emissions in fires, underline that assessment of flame retardants should consider both reduction of heat release and smoke emission, and conclude that the parameters developed in this study provide a useful tool to do this.

"New Insights into the Investigation of Smoke Production Using a Cone Calorimeter", R. Sonnier (ITM Mines Alès), H. Vahabi (Université de Lorraine, Metz) and C. Chivas-Joly (LNE), Fire Technology 2019 https://doi.org/10.1007/s10694-018-0806-z
A summary of this study was already presented at AMI Flame Resistance in Plastics Conference 2018, see pinfa Newsletter n°98.

pinfa promotes PIN FR recycling at IERC

With 450 participants from all over the world, IERC (International Electronics Recycling Conference) is one of the most influential global meetings of electronics waste (WEEE) recyclers. Hosted in Salzburg, the 18th IERC (January 2019) was well attended with a strong European industry presence. The conference included several presentations addressing issues with recycling of polymers containing halogenated flame retardants. Keynote presentations shed a light on the future amendments to the Basel convention, now that China has implemented a ban on import of plastic waste, and to the EU POP Regulation. It is expected that POP recast will push for ever lower contents of POPs in plastic waste, including certain brominated compounds, which may drive the demand for substitution products such as PIN FRs. pinfa participated in the exhibition with a booth, sharing updates on its projects and activities. 2019 will see further developments of PIN FR recycling activities, with latest progress of the pinfa-Fraunhofer Institute work to be featured in a video and a joint pinfa-AIMPLAS workshop to take place on April 4th, 2019 (see www.pinfa.eu under “Events”).

18th International Electronics Recycling Congress IERC 2019, January 16 – 18, 2019, Salzburg, Austria www.icm.ch



Trends in science concerning consumer chemicals

An analysis by two US researchers of scientific publications concerning consumer chemicals identified some 1 900 published papers ever and up to the end of 2017, screened down to 342 papers referring to specific chemicals, endpoints or applications. Numbers of publications increased considerably since 2006, increasing to 2014, and then maybe declining somewhat. The most frequently studied chemicals were phthalates, bisphenol-A and PBDEs (brominated flame retardants). Frequency of publications is stated as having “surged” following regulatory changes or exposure incidents (there is no statistical analysis to support this statement). The authors note that most of the identified papers address a small number of chemicals, and suggest that this leaves a knowledge gap for many other chemicals.

“Health risks of chemicals in consumer products: A review”, D. Li & S. Suh, Environment International 123 (2019) 580–587 https://doi.org/10.1016/j.envint.2018.12.033

AEI offers new cable performance for fire safety

The new Total Fire Solutions cable and related products range from AIE Cables offer up to 120 minutes fire resistance for building ventilation, smoke exhaust and escape control systems, alarms and fire communications and emergency lighting and power. The full range of cables and fittings, including Mineral Insulated Cable (MIC), Firetec Enhanced and Firetec Power, are low-smoke, zero-halogen to BS EN 50267 (IEC 60754) and BS EN 50268 (IEC 61034), using PIN flame retardants. Applications include residential and commercial buildings, shopping centres, airports and heritage buildings. Firetec references include the Francis Crick Research Institute London, Queen Elizabeth Hospital Birmingham, White City Complex London and Meadowhall Shopping Centre Sheffield.

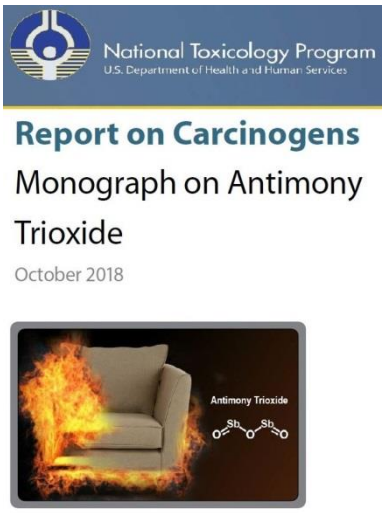
“AEI Cables launches new Total Fire Solutions”, 24th July 2018 https://www.electricaltimes.co.uk/aei-cables-launches-new-total-fire-solutions/ and Total Fire Solutions building codes guide http://www.aeicables.co.uk/products/data2.asp?navby=sect&sector=Fire%20Protection

Review of impacts of FRs on plastics recycling

A review paper from Ghent University, Belgium, summarises the effects of flame retardants on polymers in recycling (based on nine published papers) and possibilities for flame retardant use in recycled plastics. The paper looks at polypropylenes, polycarbonates, polyamides, polyesters and polyethylenes, in particular in WEEE (waste electrical and electronics). The review shows the complexity of plastics recycling, with flame retardants often impacting the process to some extent. Particular problems occur with inorganic FRs with relatively low decomposition temperatures (incompatible with recycling processing temperatures). Another difficulty is the decontamination of WEEE plastics containing those brominated FRs which are now restricted. On the other hand, a range of PIN FRs have shown to be effective as fire safety additives in recycled polymers.

Studies cited relevant to recycling of PIN FR polymers: Almeras et al. 2004 x 2, Turku & Kärki 2016, El-Sabbagh et al. 2013, Statler 2008 x 2, Imai et al. 2003, Dawson & Landry 2005.

"On the role of flame retardants in mechanical recycling of solid plastic waste", L. Delva et al., Waste Management 82 (2018) 198–206 https://doi.org/10.1016/j.wasman.2018.10.030



Regulatory pressure tightens on antimony (ATO)

Tighter regulations and questions about carcinogenicity may impact use of antimony trioxide (ATO, Sb_2O_3) as a synergist for brominated flame retardants. Germany has put into place a very low workplace exposure limit of 0.006 mg/m^3 respirable antimony since May 2018 (BAuA) and Japan implemented 0.1 mg/m^3 inhalable antimony in 2017 ('respirable' concerns smaller particles, generally <10 µm versus <100 µm for 'inhalable'). These limits are considerably lower than most limits which are generally currently 0.5 mg inhalable Sb per m^3.

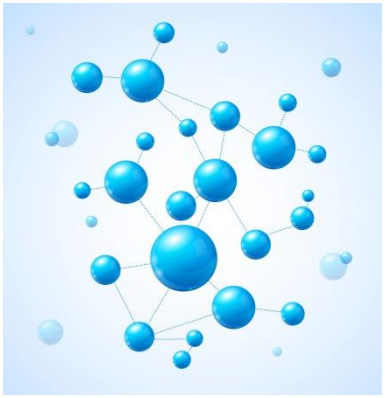
The US National Toxicology Program (US Federal Department of Health and Human Services) published end 2017 a report (NTP TR 590) on studies of ATO in rats and mice, and in October 2018 a "Report on Carcinogens. Monograph on Antimony Trioxide". This report responds to the US legislator requirement to identify substances which are known or reasonably anticipated to be human carcinogens. The report identified 5 500 references and assessed over 500, concluding that ATO can "reasonably anticipated to be a human carcinogen based on sufficient evidence of carcinogenicity from studies in experimental animals and supporting evidence from mechanistic studies". ATO was indicated to lead to increases in oxidative stress and damage, impairment of DNA damage repair and possibly inhibition of cell differentiation.

In the EU, evaluation of ATO classification for CLP is underway, led by Germany (BAuA, see above). BAuA are reported to have commented that reclassification of ATO as Category 1B carcinogen is possible, based on the US NTP reports. This could lead to consideration for classification as SVHC under REACH.

US National Toxicology Programme, 19 October 2018 "Report on Carcinogens Monograph on Antimony Trioxide" https://www.antimony.com/files/cms1/publications2016/i2a-wvm-pressrelease-baua-oel-20180814.pdf

US National Toxicology Programme, December 2017, report NTP TR 590 "NTP Technical report on the toxicology and carcinogenesis studies of antimony trioxide (CAS no. 1309-64-4) in Wistar HAN [Crl:XI(Han)] rats and B6C3F1/N mice"

"Draft US report recommends adding antimony trioxide to carcinogen list", Chemical Watch 4 January 2018 https://chemicalwatch.com/62844/draft-us-report-recommends-adding-antimony-trioxide-to-carcinogen-listhttps://ntp.niehs.nih.gov/ntp/htdocs/lt_rpts/tr590_508.pdf



P-functionalised chitin as waste-sourced PIN FR

Chitin nanofibrils, functionalised with phosphorus, combined or not with nano-clay (montmorillonite), were used to prepare films (approx. 25 µm), and tested for fire resistance and as fire barrier materials. The seafood industry produces millions of tonnes of chitin waste materials annually (crustacean shells and cuticles), already used today in e.g. cosmetics, water treatment or biomedicine, and recognised to be non-toxic, antibacterial and biodegreadable. The nano-crystalline fibril structure of this chitin has been "optimised by nature" for mechanical strength and modulus. Its content in internal amides and surface amines impairs some inherent fire resistance. This research shows that chitin can be surface de-acylated using simply aqueous sodium hydroxide, then functionalised with phosphorus (again with an aqueous reaction). Papers produced with P-functionalised chitin showed significantly improved vertical flame resistance and total heat release, compared to chitin reacted with acetic acid or chlorine. Papers produced from phosphorus-functionalised chitin plus montmorillonite showed both mechanical performance comparable to carbon nanofibre paper but also effectiveness as a fire barrier.

"Sustainable Chitin Nanofibrils Provide Outstanding Flame-Retardant Nanopapers", F. Riehle et al., Biomacromolecules 2019 https://doi.org/10.1021/acs.biomac.8b01766

FireSafetyTools
Codes Regulations Standards

FireSafetyTools informs on codes and regulations

The new website service "FireSafetyTools" provides an online database of fire safety codes, regulations and standards, designed to help industry identify what fire safety performance requirements are applicable to a given product or material in a given market. Relevant fire tests are also referenced. The database covers building and construction, transport, E&E, electrical engineering, wire and cable, furniture, textiles and others with over 2 800 national and international standards documents available.

FireSafetyTools – codes, regulations, standards: https://firesafetytools.com/

Publisher information:

This Newsletter is published for the interest of user industries, stakeholders and the public by pinfa (Phosphorus Inorganic and Nitrogen Flame Retardants Association), a sector group of Cefic (European Chemical Industry federation). The content is accurate to the best of our knowledge, but is provided for information only and constitutes neither a technical recommendation nor an official position of pinfa, Cefic or pinfa member companies.

For abbreviations see: www.pinfa.org

pinfa, Avenue E. Van Nieuwenhuyse 4, 1160 Brussels, Belgium
pinfa@cefic.be Phone +32 2 676 74 36 www.pinfa.org
@pinfa_eu