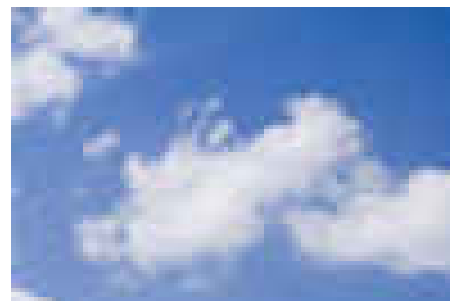




**MHE Technologies (Aus) Ltd**

**The Molecular Heat Eater® - The Next Generation Flame Retardant**

**The Competitive Clean-Tech Alternative for Environmentally-Committed Manufacturers**





# MHE Technologies (Aus) Ltd

We know we have something unique to offer. Our flame retardant solution not only provides ignition resistance, helping to slow down the rate of combustion. It stops it completely.

MHE® is the world's first flame retardant which contains no bromides, no aluminium, no chlorines, no phenols, no phosphate esters, no urea, no nitrogen, no ammonium or any other known harmful substances. *It contains only substances which are classified harmless and 100% biodegradable.*

- ⇒ Lower cost
- ⇒ Meets or exceeds fire safety regulations
- ⇒ Green and environmentally safe
- ⇒ Works with existing production infrastructure
- ⇒ Independently tested

Welcome to the next generation of flame retardants!





The manufacturing industry has been trying to come up with new, less harmful flame retardants alternatives for years. Until 2004, there was nothing but toxic solutions available, based on bromine, phosphorus, aluminum, chlorine and other harmful chemicals.

In 2004, following ten years of R&D, Swedish innovation company Trulstech launched the Molecular Heat Eater® (MHE®), the world's first flame retardant which is classified harmless .

MHE® is not ONE chemical. MHE® is a flame retardant system based on a portfolio of combinations between various carboxylic acids and alkali hydroxides. All substances used in the solution are *E-classified* approved food additives.

The technical adaptive design of MHE® caters to a variety of aspects, to achieve an optimal application, safeguarding customer satisfaction.

MHE® "grades" are tailored and flexible with adaptations made for our customers based on:

- o **Choice of substances** – different combinations of various carboxylic acids and alkali compounds depending on target material.
- o **Powder particle size**, from dust to minimal particle size at 5-10 micron and upwards.
- o Soft powder (uncoated or coated) working as **reactants** (MHE® reacts with polymers and plastic materials) **or** **fillers**.



**Cost-efficiency** –R&D with MHE® shows that a lesser amount per weight unit is needed to meet performance requirements.

Primary benefits

a) A cost-efficient solution through relatively low added weight percentage and raw material cost

Secondary benefits

b) MHE® carries an inherent catalytic functionality, enabling a reduction certain additives.

c) Zero waste, no recycling required, and no need for protective gear and contained manufacturing environment thanks to the 100% harmless contents of MHE® ⇒ Cost-savings downstream.

**Functionality** – Combined, superior intumescent and endothermic capabilities.

**Light Weight** - Focus on applications where weight and space is critical, e.g. paint, coatings, in the transport industry etc.

**Environmental** – Increasing focus globally on recycling and impact on human health of chemical substances used in home environments, cars etc. MHE® enables manufacturers to get one step closer to completely non-toxic and biodegradable products.

**Innovation & Product Differentiation** –MHE® provides an opportunity to achieve and retain technology leadership and gain a strengthened competitiveness in the marketplace.



### New Advantages to be Gained for Manufacturers Across Multiple Sectors

**Transportation Industry** - Automotive, vehicle interior manufacturers

**Plastics and Chemicals** - Adhesives, paints, coatings, lacquers

**Furniture and Appliances** - Sofas, curtains, bedding and mattresses, wall-to-wall carpeting and underlay

**Electronics and Electrical Manufacturing** - Computer hardware, PC-boards, cabling and pipes

**Construction** - Building materials, Interiors and decoration production, flooring, insulation, particle boards

To date, MHE® solutions for different materials have been successfully developed.

- Polyurethane (PUR)
- Polymer filters
- Cellulose, Fabrics (Cotton, Polyester, Wool)
- Latex foam
- Rubber / EPDM
- Craft and carton paper
- Polyester
- EPS and XPS
- Other natural fibres, woven /non-woven fibres, bio-fibre
- Wood and wood fibres, wood panels and fibre board
- Bio-polymer
- Bitumen

### New Applications Currently under Development

- Epoxy, Linoleum and parquet flooring,
- 100% recyclable biopolymers
- Cabling and conductors
- ABS
- Extruded rubber



## Examples of Application Areas

**EPDM Rubber**

Panels, tubes

**Thermoplastics**

Electronic boxes, cabling, interior components, dash-board, safety-belt buckles, car doors

**Polyurethane Foam**

Seating, cushioning, shock-absorbers inside metal beams, ceiling, sound insulation materials

**Fabrics**

Seat covering (textile, leather), carpeting, interior of car doors, ceiling, interior of trunk

MHE® can work as a [reactant](#) or as an [additive filler](#):

- As a soft uncoated or coated fine powder for compounding into a material before molding
- As a surface treatment
- In aqua solution



## Case Study Example:

Treatment of flexible polyurethane foam used in car seats, furniture, bedding etc.

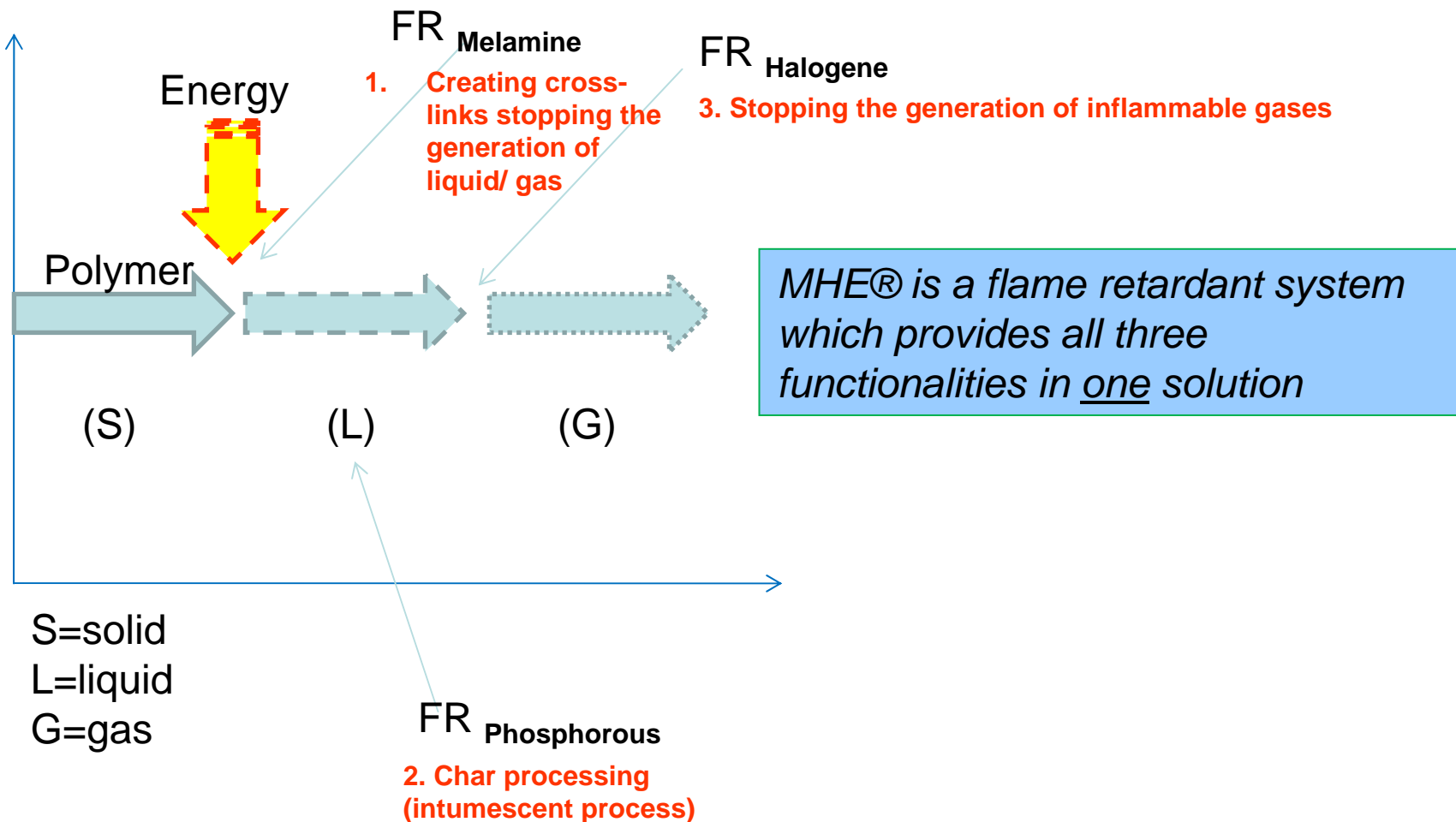
*Figures are estimates and not absolute!*

Commonly used:	Rate & Cost	MHE® Rate
<b>-TCPP</b> (TrisChloropropylphosphate)	<b>Alt. I</b> TCPP:8~20% (Yoke) Chlorine-phosphorous: 10%	5-10%
<b>-Chlorinated aliphatic polyphosphate-phosphonate</b>	(Reofos/ Fyrolflex) <i>plus catalyst additives,</i> handling and recycling costs.	100% biodegradable in nature, classified as foodstuff and totally harmless.
<b>-Melamine</b> (or combinations with bromines)	<b>Alt. II</b> Melamine 30-40wt%	

### Example of Health & Environmental Consideration:

**TCPP** is carcinogenic, generates chlorine gas (flame retardants containing such substances are forbidden in children's sleepwear in the USA).

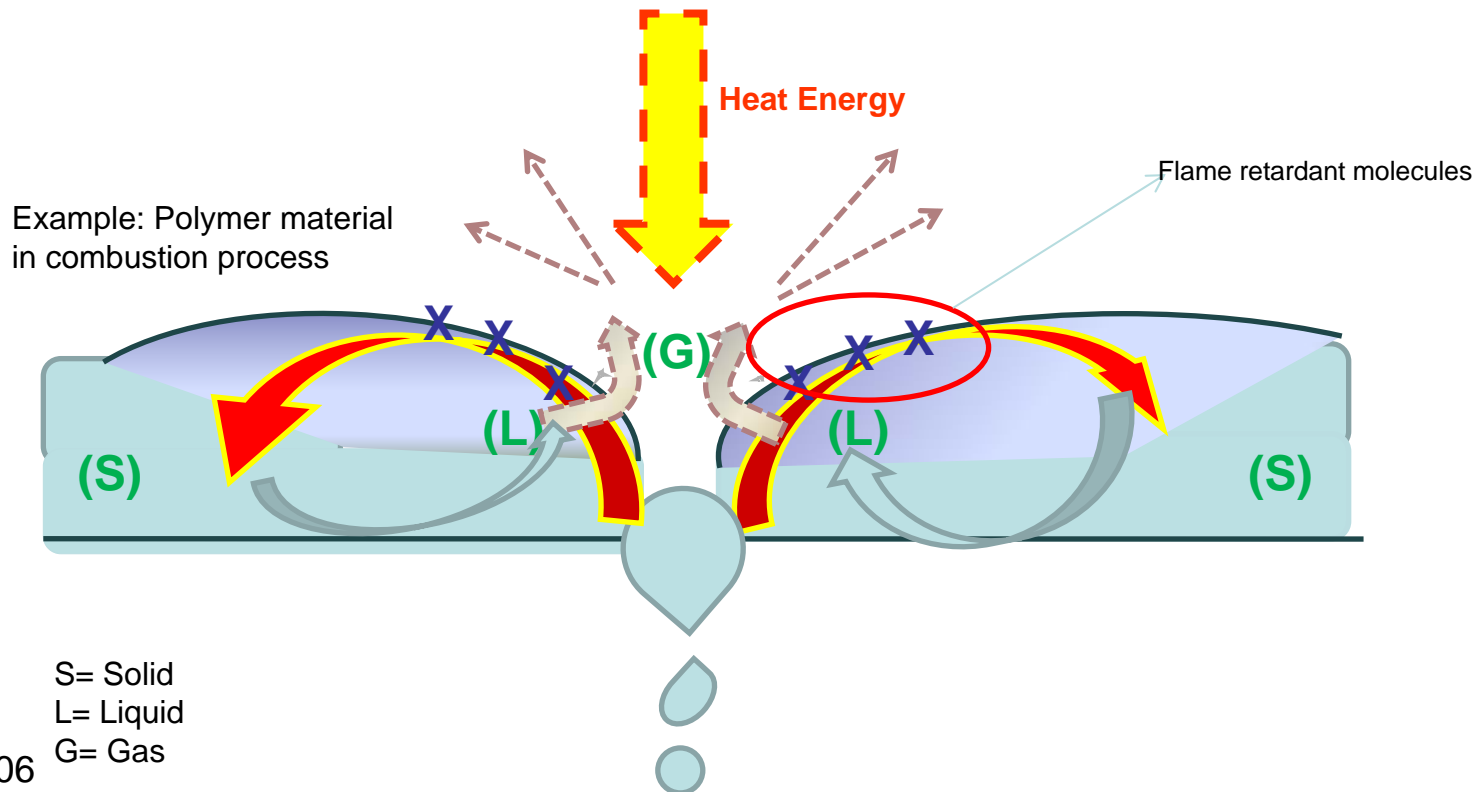
**Melamine** damages kidneys and the urinary tract in living organisms. Causes allergic reactions.





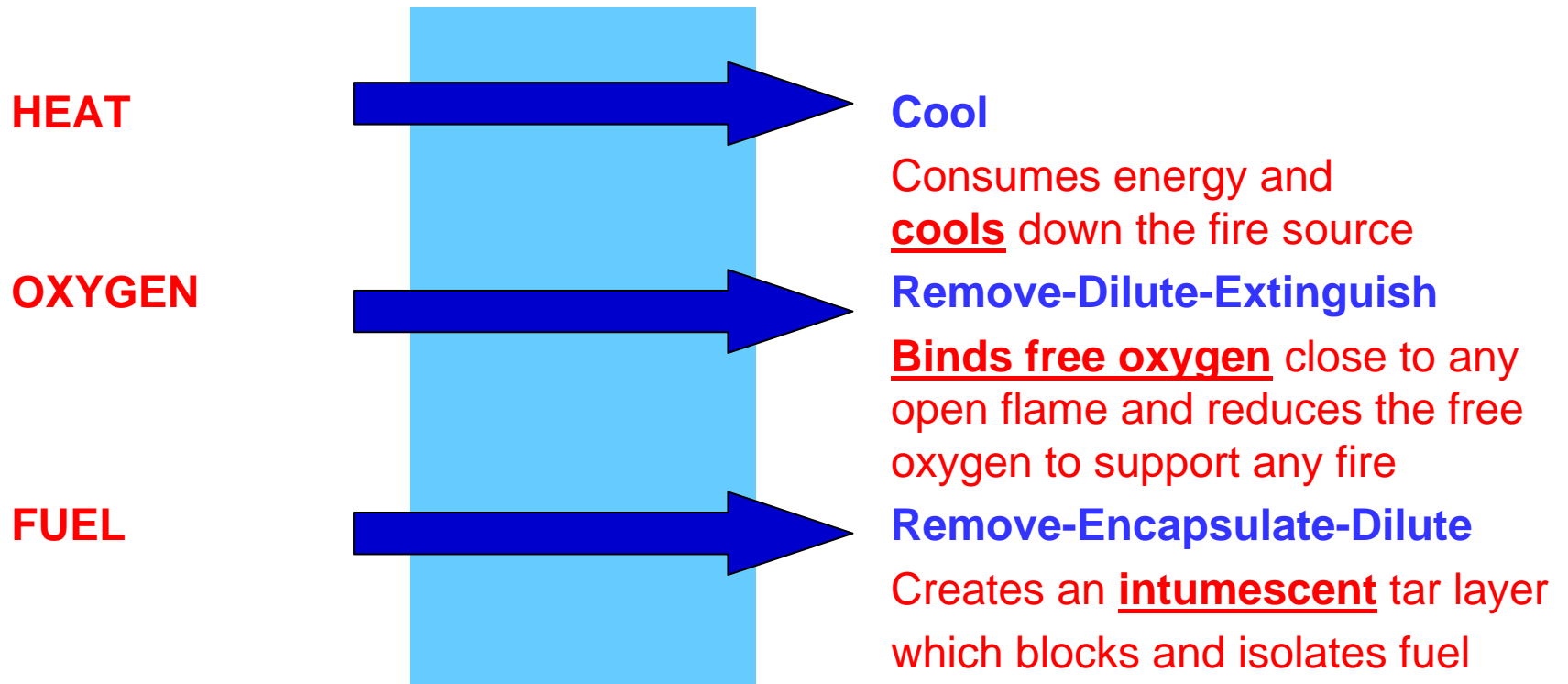
When a material exposed to heat energy, for example ABS, it is transformed from solid to liquid phase the liquid phase moves away from the heat energy source. Commonly used FRs, which are mostly based on two-dimensional molecules, will simultaneously be transported in the liquid material, away from the heat, without a chance to stop the generation of inflammable gases the area of the melting process. Hence liquid material drips at the heat focal point.

MHE® is based on **three-dimensional** molecules which enables a char-forming process close to the heat source, **blocking any dripping of melted material and stopping the fire completely.**





## The Combined Flame Retardant Capability of MHE®





**Patented:** World-wide, through patent attorneys Collison & Co. MHE® received the Gold Medal for the patent of the year at the Seoul International Invention Fair, 2004.

**Product form:** Soft coated or uncoated powder in a broad range from dust to  $\text{Ø} < 5\mu\text{m}$  and upwards (adaptable according to application), in gel form or in aqua solution with varying concentration.

**Ingredients:** Combinations of carboxylic acids and alkali hydroxides.

**Acidity:** Flame retardant  $\Leftrightarrow \text{PH} = \sim 7,1$  (6,9-7,4); Transparent liquid to penetrate material. No smell after air-drying. Fire Fighter  $\Leftrightarrow \text{PH} = 6,5-6,8$ ; Mostly used in gel form. A slight viscous yellow liquid with extremely good endothermic characteristic.

**Functionality:** Cooling and intumescent

**Application weight percentage required:** Depends completely on the specific material application. Ranges from 3% for EPDM rubber, to 5-10% in general for polymer and fibre materials based on applications at present time.

**Tested capability:** Room Corner Test, Euroclass B Single Burning Item (SBI), Crib 5, Crib 7, Limited Oxygen Index. The Cone Calorimeter tests show the retardant surpasses  $25\text{kW}/\text{m}^2$  heat radiation without ignition or flaming for well in excess of 30 minutes (ISO), and  $50\text{kW}/\text{m}^2$  in excess of 25 minutes.

**Hazardous or toxic impact:** None. Classified harmless with no toxic or harmful impact on humans or the environment. Repeated exposure to MHE® in any form may cause dry skin. When in contact directly with the eyes, this may cause irritation and pain.

**UV-Resistant:** Yes

**Impact on viscosity:** Marginal, if any.

**Decomposition or conversion bi-products:** Carbon-dioxide and water

**Degradability:** MHE® is completely biodegradable in nature.

**Temperature tolerance and freezing point:** Solidifies at  $-20^\circ \text{C}$ . Boiling point of water solution: appr.  $+120^\circ \text{C}$

**Activation temperature:**  $< \text{Ø} +300^\circ \text{C}$

**Smell:** Light smell of vinegar, which diminishes through drying.

**Supply:** In standard C-Pack containers, in custom-sized sealed plastic bags.

Handling and storage in normal room temperature. Storage or larger quantities requires standard ventilation.



## People We Work With

- The Swedish Institute for Surface Chemistry [www.yki.se](http://www.yki.se)
- Karolinska Institutet, Stockholm Medical University [www.ki.se](http://www.ki.se)
- The Royal Institute of Technology, Stockholm Sweden [www.kth.se](http://www.kth.se)
- Eurenco Bofors (former Alfred Nobel Chemical Industry)  
[www.eurenco.com](http://www.eurenco.com)
- The Swedish Environmental Protection Agency [www.naturvardsverket.se](http://www.naturvardsverket.se)
- The Swedish Chemicals Inspectorate [www.kemi.se](http://www.kemi.se)
  
- **The Ian Wark Research Institute** [www.unisa.edu.au/iwri](http://www.unisa.edu.au/iwri)  
"The Wark" is the industrial services spin-off from the University of South Australia, Adelaide. The Wark is specialised in polymer research and services some 270 companies across various industries, including aerospace, automotive manufacturing, polymer manufacture, paints, wood, paper and composite boards.
  
- **Institute for Polymer and Fibre Research** [www.ifp.se](http://www.ifp.se)  
IFP Research is a public-private toll processing facility in Sweden with specific competencies for product R&D with a focus on chemical, physical and mechanical properties of fibrous and polymeric materials, production technologies of, textiles, plastics, non-wovens and rubber products and related waste management. IFP is commissioned by world-leading companies such as IKEA, Volvo and SAAB.



## International Awards and Recognition

- Finalist in Environmental Innovation Sweden (Miljöinnovation) 2003
- Winner of the Gold Medal at SIIF Seoul International Innovation Fair 2004
- Special Award by the South Korean Patent Attorneys Association 2004
- MHE® was selected to represent Swedish Hi-Tech at Delta Forum 2005 in Shanghai, 2005
- Global finalists in the BBC World Challenge 2006 (1 of 12 world-wide), competition sponsored by SHELL Petroleum and Newsweek
- Nominated for the 2007 USA TECH AWARDS, a United Nations competition honors innovators from around the world who are applying technology to benefit humanity.

Other: Selected as one of six papers to be presented at the annual Fire Retardant Conference in Tokyo 2007



PRODUCTION COST  
**MOLECULAR HEAT EATER**  
DESIGN FUNCTIONALITY  
ENVIRONMENT & HEALTH  
**MOLECULAR HEAT EATER**  
SAVING YOUR LIFE & PROPERTY

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