Three fire retardant soft PVC with excellent environmental performance, ready for industrial use

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The overall objective with the formulations presented in this document is to improve the environmental performance of the PVC application with the same or better fire and smoke performance.

The products physical and processing properties are the same or similar to initial recipe.

A summary of our results are presented in the form of three formulations for three products.

The formulations have been developed by Deflamo in cooperation with customers and partners.

The method used included changing total PVC formulation:

- Modifying total formulation, including stabilizers and other additives
- Replacing Antimony trioxide (Sb2O3) and no phosphate esters or halogens
- New environmentally friendly plasticiser: Pevalen from Perstorp or widely used DINP
- Evaluate Apyrum and its synergistic functionality with other flame retardants
- Formulation ready to use by industry with possible adjustments
Fire testing and test parameters

- Equipment: Cone calorimeter (iCone from Fire Testing Technology Ltd. FTT)
- Operated by Deflamo AB
- Size of the sample: 100 mm x 100 mm, thickness: 1,0 mm
- Surface exposed to heat: 88,4 cm²
- Heat flux: 35 kW/m² (ca. 700°C)
- Distance to sample: 25 mm
- Horizontal test
**Product 1: Technical textile**

- Application is soft and strong PVC-coated fabric that passes classification BS2d0 according to Euroclass (EN 13501-1)
- Our customer is currently using phthalate plasticiser and antimony trioxide (Sb2O3) in the formulation. The objective is to remove these harmful substances
- The graphs show the current commercial formulation (reference) in comparison with the new formulation marked “Apyrum, ATH, Pevalen”. Similar or slightly improved heat release, dramatically improved smoke release
Product 2: Floor and wall cover

- Medium soft PVC film produced with calendaring for use in flooring and wall cover applications.
- High performance regarding fire- and smoke performance. Formulation with widely used plasticiser DINP. Carefully selected components gives very good environmental performance.
- Graphs Illustrates dramatically improved heat release and flame out. Also synergism between Apyrum and Zinc hydroxy stannate (ZHS)

S-PVC 100
Diisononyl phthalate (DINP) 40
ESBO 3
CaZn 3
Apyrum 12
Zinc hydroxystannate (ZHS) 4

4 phr ZHS, 12 phr Apyrum
Product 3: Industrial tarpaulins, tent cloth

- Plasticised PVC film produced by a coating process for use in reinforced architectural and technical tarpaulins
- Comparison of three formulation with green plasticiser Pevalen and comparison between flame retardants functionality
- Formulation 2, with Apyrum and synergists is performing better than formulation 3 whit Antimony (ATO). Formulation 2: Smoke performance is excellent

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Conclusions:

- Three product samples based on formulations that can substitute toxic and harmful flame retardants with similar or better fire performance
- The combination of environmentally sound formulation in combination with high flame retardancy is possible
- Data from cone calorimetry illustrates:
  - Apyrum is adding functionality and value to commercial applications
  - Apyrum and Pevalen functions well in combination
  - Possible to exclude ATO and Phosphate esters and still meet highest flame retardancy requirements
  - Apyrum outperforms ATO regarding smoke release
  - Apyrum is synergistic with ATH and ZHS and more

This data and information is presented by Deflamo and tests and samples are based upon samples prepared by Deflamo and or partners / customers. Fire tests is made by Deflamo as a part of customer development projects and some detailed information is excluded to not infringe the rights of other parties. Fire testing is not verified by third party fire lab.