TECHNICAL INFO SHEET

The use of Phosphate salts
Fire and flame retardant agent

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Fire & flame retardants – application review

Why are phosphates used in "flame retardant" product? Active Ingredient

Flame Retardant additives (FR additives) are organic or inorganic ingredients used in fire-proofed materials to prevent the ignition and delay the spread of a fire. Introducing inorganic phosphates mineral additives as flame- & fire-retardant supports and enforces public safety to prevent tragic and destructive fire-outbreaks in households, buildings, or wild forests by directly tackling the destructive mechanism. Since a fire can self-sustain when 4 key elements are combined, namely: Heat, Fuel, Oxygen and Chain reaction, tackling them altogether justifies the diversity of additives, since a careful combination is the best way forward to deliver fire retardancy & protection.

The retardancy is commonly intended as an *active* or *reactive* action, but the type of application creates new constraints of applicability and fire-proofing expectations. Some examples of this are extinguishing foam or impregnated textile and fabrics. It is a challenge to offer an optimal fire resistance by tackling altogether the fire's 4 elements through phosphates without impeding on the fabric quality or integrity.

The objectives for phosphate additives are to inhibit or delay the generation of heat, cut off the flame's access to oxygen or fuel material (e.g. flammable gas), interrupt the chain reactions (e.g. free radicals' propagation), and promote the formation of an insulating char by swelling. Different phosphorus-based additives display fire retardant effects, like organophosphates, phosphonates, soluble & insoluble inorganic phosphate salts (halogen-free), and halogen-retardant containing phosphorus as an auxiliary. A recent modern requirement for FR-additives is for performance & safety in balance with eco-friendliness to improve our daily lives unlike alternatives containing chlorides, bromine, or complex polymers which are harmful persistent pollutants.

Ammonium phosphate salts absorb energy and release water during thermal degradation, promote a "char formation" for a protective layer in the case of inorganic polyphosphates, or contain the propagation in the case of some organophosphates. Used in dry or liquid form in applications, additives may be mixed with the base material (retardant additive) or chemically bonded in a fabric (reactive flame retardants). Used as a single active or synergy ingredient, phosphorus-based retardants are compatible with different applications to tackle fire with a unique & excellent eco-friendliness.

Ammonium monophosphate MAP & DAP are popular in fire extinguishers of ABC powder type, using up to 50% or more of the weight of the mixture as it benefits from a good water-solubility, efficiency on fire, mineral filler function, and its environmental-friendly status. To flameproof cloth or paper for instance, the fabrics can be sprayed with or dipped in ammonium phosphate solution and dried, adsorbing a target near 3 to 5% w/w of the additive. Ammonium polyphosphates, which are long chain ammonium phosphate, offer further retardancy when applied in the protection of steel, paints, or coatings by enabling absorption of heat, water release, & insulating char formation. Polyphosphoric acid increases the reaction with cellulose & lignin materials (wood-based) to offer a shortcut in generating a protective char-layer, instead of generating volatile & flammable compounds. In preventive application like wild-fires, ammonium phosphates and polyphosphoric acids help to control fire-outbreaks by coating the vegetal materials with a viscous solution sprayed by aerial means. As non-hazardous and highly soluble mineral additives, they also promote soil fertilization as a nitrogen and phosphorus source while it is washed out by rains, supporting the re-birth of wild flora.

Today, phosphorus-based chemistry is a versatile potent flame retardant that can be used as a liquid, powder, or additive, which are amongst the least harmful and most sustainable solutions in the long term.

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