American Chemistry Council | Organic Peroxide Producers Safety Division

Selection of Absorbents for Spills of Liquid Organic Peroxide Formulations

The Organic Peroxide Producers Safety Division (OPPSD) of the American Chemistry Council (ACC) provides guidance documents regarding safe handling, waste disposal and spill cleanup for liquid organic peroxides.

Organic Peroxides are hazardous and may decompose in a dangerous way if they are handled at too high of temperature or if contaminated by certain materials. Such conditions may result in dangerous scenarios such as the liberation of heat or a severe fire.

Every liquid spill cleanup procedure for organic peroxides must begin by adding absorbent material but must be followed by wetting the absorbed sill with water. Although water may not be miscible with the organic peroxide being cleaned up, it acts as an effective heat sink to prevent the self-accelerating decomposition of the peroxide and dilutes any destabilizing agents that might be present.

One of the basic steps in cleaning up a spill of liquid organic peroxides is to select a proper absorbent, one that will not destabilize the material. Inappropriate absorbents may lead to decomposition. Responders may make a cleanup effort worse if they use an inappropriate material to absorb spills. This document gives an overview about the concerns related to proper selection of an absorbent. It does not deal with all the details of spill cleanup found in the other bulletins developed by OPPSD, available at www.americanchemistry.com/oppsd. All handlers of Organic Peroxides should consult with their own compliance experts and legal counsel regarding safe and compliant management of materials.

Materials that may have been used for absorbing liquid organic peroxides include cat litter, inert sand, diatomaceous earth (DE), bentonite clay, baking soda, vermiculite, instant oil spill absorber, and peat moss, for example. **These materials generally should not be used as absorbent materials for Organic Peroxide spills.**

Many of these materials are natural and the composition may not be consistent. Cat litter may be made from corn, coconut hulls, wheat, or wood materials. Diatomaceous earth is silica (which is generally inert) containing the fossilized remains of prehistoric algae. Bentonite clay is volcanic ash. Vermiculite is the name of a group of hydrated laminar minerals (aluminum-iron magnesium silicates) which look like mica. Peat moss is decayed, dried sphagnum moss; this plant matter is highly variable and may be acidic.

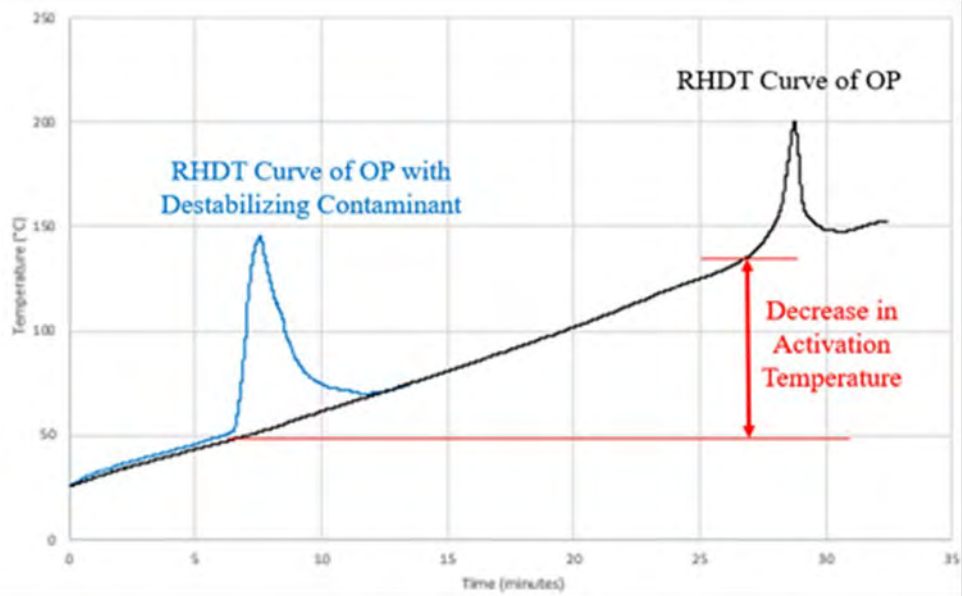
While these materials may be easily obtained, are potentially low in cost, and useful for other scenarios, they may induce a hazardous situation when used to clean up spills of liquid organic peroxides. Many incidents have occurred in the past in which a seemingly innocuous absorbent was applied to an organic peroxide spill only to result in destabilization of the peroxide manifest as smoking or even fire. There are over 100 formulations of organic peroxides offered to the market. These formulations are composed of active ingredients that are from 10 different structural classes. Some formulations (such as MEKP) include hydrogen peroxide, which is highly sensitive to contamination.

OPPSD has completed tests of various absorbent materials in contact with some typical organic peroxide formulations to observe the destabilization that may occur when using some absorbent materials. In particular, the testing was used to determine if newer polymeric based absorbents would avoid the destabilization seen with the previously mentioned materials. **As shown below, polypropylene-based absorbent pads/berms generally posed the lowest risk of destabilization when used as spill cleanup absorbents for organic peroxides.**

The polymeric absorbent offers some convenience when final disposal is undertaken, often accomplished by incineration. The polymeric absorbent is consumed in the incineration process while some of the mineral-based materials leave residues in the oven, which is undesirable for disposal companies. Polymeric absorbents are offered in pads and booms which may be used to block flow of liquids and are easily gathered up and moved to recovery drums, for example. They are made from synthetic components and are therefore more likely to be consistent in behavior.

The testing conducted to illustrate the destabilizing potential of these absorbents was the Rapid Heat Decomposition method. In this method, a test tube containing the organic peroxide is electrically heated in a heating block with a temperature ramp rate of 4°C/minute until an exotherm is detected by a thermoprobe placed in the test tube. The results of these tests of the organic peroxide alone and when mixed with the absorbent are compared to determine whether the absorbent material caused the organic peroxide to decompose at a lower temperature. If it was observed that the test that included the absorbent caused an earlier decomposition, then it can be interpreted that the absorbent destabilized the organic peroxide and that this material should not be used for cleanup purposes.

The plot below shows a typical outcome when an organic peroxide formulation is destabilized due to contact with a material used for absorbent.



The results of testing are summarized in the table below where the onset temperature for various organic peroxides is compared to that material plus the listed absorbent sample. Due to the natural character of some materials the reactive characteristics may vary by source as well. This testing is only intended to be illustrative. Each user should evaluate their own practices for suitability. A prescribed method and materials for cleaning up these hazardous materials should be developed by users and response personnel should be trained which materials to use and which to avoid for absorbing spilled materials, taking into account all safety concerns discussed in other OPPSD documents. **Note:** Inclusion in this table is not intended to be an endorsement of any particular material and not a warranty of the effectiveness or fitness for a particular purpose of any listed material.

Onset of Decomposition of Organic Peroxides Alone and with Absorbents (°C or °K)												
	MEKP		TBPB		CUHP		BCUP		TMCH		TBPEHC	
Organic Peroxide Alone	130		120		170		140		110		130	
	Onset	Difference	Onset	Difference	Onset	Difference	Onset	Difference	Onset	Difference	Onset	Difference
Typical Oil Absorbent	115	-15	120	0	50	-120	100	-40	90	-20	130	0
Vermiculite	110	-20	120	0	120	-50	140	0	110	0	130	0
Peat Moss	125	-5	120	0	160	-10	140	0	110	0	130	0
Cat Litter	120	-10	120	0	155	-15	140	0	110	0	130	0
Polypropylene Fiber Absorbent	130	0	120	0	170	0	140	0	110	0	130	0

MEKP = Methyl Ethyl Ketone Peroxide
TBPB = tertiary-Butyl Peroxybenzoate
CUHP = Cumene hydroperoxide
BCUP = tertiary-Butylcumylperoxide
TMCH = 1,1 bis tertiary-Butylperoxy 3,3,5 trimethylcyclohexane
TBPEHC = tertiary-Butylperoxy-2- ethylhexylcarbonate

As seen in the above testing, polypropylene-based absorbent pads/berms generally posed the lowest risk of destabilization when used as spill cleanup absorbents for organic peroxides. Additionally, industrial experience has demonstrated that calcium carbonate and sodium bicarbonate have also worked well when used as spill cleanup absorbents for organic peroxides.

For further safety handling and disposal procedures, please visit the Organic Peroxide Producers Safety Division page (OPPSD) at Organic Peroxide Producers Safety Division (OPPSD) (americanchemistry.com).