HYDROSIL
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➢ HS-600 provides a significantly longer service life than potassium hydroxide impregnated carbon.

Hydrosil HS-600 has 3.6 pounds of active ingredient as compared to 1.6 pounds of active ingredient (32 pounds per cubic foot times 5.0%). Mathematically, the service life of HS-600 is 125% greater.

➢ HS-600 is effective on a broader spectrum of gaseous pollutants.

Potassium permanganate used in the Hydrosil HS-600 production process chemically produces manganese dioxide (MnO_2) and manganese tetraoxide (MnO_4), in addition to potassium hydroxide (KOH). Manganese dioxide/tetraoxide is effective in removing sulfur dioxide, nitrogen dioxide, chlorine dioxide and mercaptans. These chemicals are not present in potassium hydroxide impregnated carbon. Typically corrosive pollution in a plant environment is caused by a broad group of chemicals and potassium hydroxide impregnated carbon is too focused to handle this broad spectrum.

➢ HS-600 does not support combustion.

Potassium hydroxide impregnated carbon will support combustion.

➢ HS-600 provides a visual indicator when the media is spent.

The manganese dioxide/tetraoxide produces a purple color, which evolves to a dull brown as the media is spent. Testing is the only reliable way of knowing the remaining productive service life of the media. Visual indications are useful in prioritizing the need to test.

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Effectiveness of Chemisorption on Chlorinated Solvents

➢ Mechanism of removing vinyl chloride in air with potassium permanganate

Activated carbon is used to remove many chlorinated solvents in air streams. If the isotherm (adsorption capacity) is good this is the best method. In the case of low molecular weight chlorinated solvents this isotherm is not very good. In these cases we must use other mechanisms for the removal of the pollutant gas. The alternative to adsorption/absorption is to have the gas adsorbed into a substrate and have a chemical reaction to neutralize or oxidize the pollutant. This mechanism is understood to be chemisorption.

Potassium permanganate is a very good chemical to perform both the neutralization and oxidization process in air. When potassium permanganate is hydrated it will form three compounds. These compounds are potassium hydroxide, manganese tetraoxide and manganese dioxide. The in the case of vinyl chloride the manganese tetraoxide will oxidize the vinyl chloride into potassium chloride and carbon dioxide. The potassium chloride will remain in the pore structure of the substrate that contains the hydrated potassium permanganate.

Hydrosil impregnates a molecular sieve of zeolite with 6% by weight potassium permanganate. This media is called HS-600. Field applications of this media in removing vinyl chloride from air streams have been proven to be efficient and economically better than that of activated carbon. In field studies, the spent media was tested and determined that it did not pose a hazardous waste. The spent material was disposed in a landfill. In using this media, a representative sample should be tested for hazardous materials prior to disposal in a landfill as a non-hazardous waste.

It should be noted that if other higher molecular weight chlorinated substances are present in the air stream it is advisable to place activated carbon scrubber systems prior to the potassium permanganate system. This will increase the efficiency of the systems and result in decreased operating costs.

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REACTION FOR THE REMOVAL OF VINYL CHLORIDE USING POTASSIUM PERMANGANATE

The reaction of permanganate ion with vinyl chloride monomer is outlined in Figure 1. The reaction produces 1,2 dihydroxy, chloroethane, an addition product, and a precipitate of manganese dioxide. A short description of the reaction is also included below. The typical oxidation reaction for an alkene by permanganate ion may be found in any general organic chemistry text.

The oxidation of an alkene leads to the formation of a compound with hydroxyl groups on the carbon atoms that were involved in the double bond, a 1,2 diol. Manganese (VII) in permanganate ion is ultimately reduced to manganese (IV) in manganaese dioxide. The carbon atoms of the double bond are oxidized. Even if no base is added at first, the solution becomes progressively more basic as the reaction proceeds.

In this oxidation reaction, the two hydroxyl groups become attached to the same face of the double bonds. The permanganate ion is believed to add to the double bond to give a cyclic intermediate, a manganate ester. The first step of this reaction is the syn (same side) addition of permanganate ion to the double bond. This intermediate breaks down in the presence of water to give the cis-1,2 diol. Thus, there are no appreciable quantities of chlorine gas or formaldehyde formed in the reaction.

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Reaction Mechanism of Permanganate Ion with VCM (Vinyl Chloride Monomer)

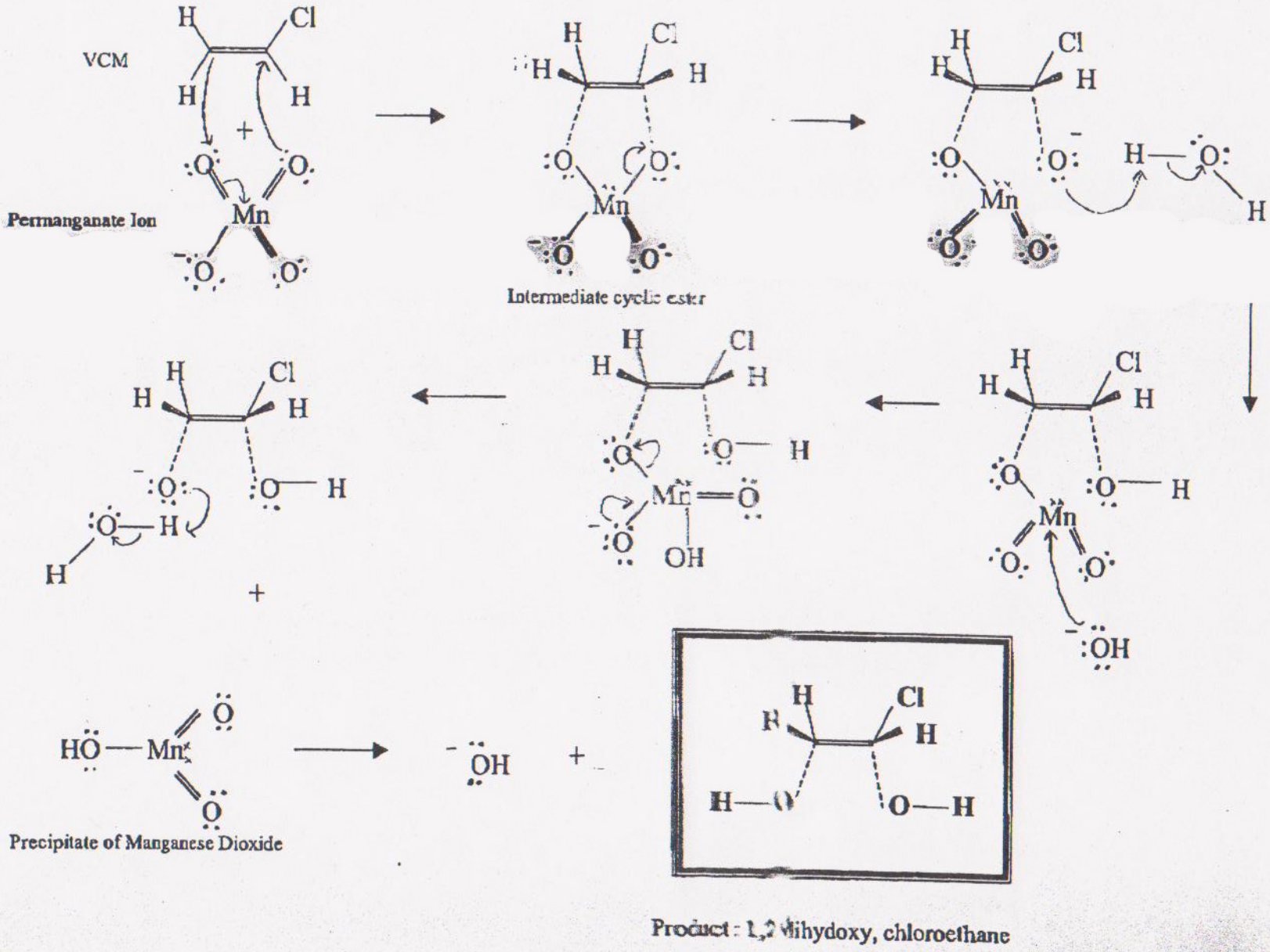

FIGURE 1

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Remaining Service Life

The percentage of available potassium permanganate and the density of the gas phase media can be correlated to the active service life left in the product. If the media in the adsorber is Hydrosil HS-600 or an activated alumina based product, the following schedule can be followed:

Hydrosil HS-600 Percentage of Potassium Permanganate (% by weight)		Activated Alumina Percentage of Potassium Permanganate (% by weight)
2.2 to 6.0	**SAFE**	2.6 to 4.0
1.6 to 2.2	**BORDERLINE**	1.9 to 2.6
1.2 to 1.6	**CHANGE**	1.4 to 1.9
0.0 to 1.2	**CHANGE IMMEDIATELY**	0.0 to 1.4

The comments are intended to mean the following:

SAFE - Reanalyze in 90 days

BORDERLINE - Change in 30-60 days

CHANGE - Change in 30 days, breakthrough could occur quickly under plant "spill" conditions

CHANGE IMMEDIATELY - Change Immediately

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Hydrosil HS-600

Hydrosil vigorously controls the production process. Data is reviewed and maintained on each batch as it is being produced through and including the moisture content of the HS-600 being delivered to our customer.

➢ HS-600 Specifications

The potassium permanganate impregnated media shall have no less than 3.6 pounds of potassium permanganate per cubic foot, a bulk density of no less than 60 pounds per cubic foot, a moisture content of 12-15% by weight and shall not dust. The media shall have an irregular particle size of 4 x 8 mesh.

The performance characteristics of the air filtration media shall meet or exceed a service life of no less than 72 hours for breakthrough of hydrogen sulfide at the following test conditions:

Media Bed Volume: 76.00 cubic centimeters
Bed Configuration: 2.54 cm (id) x 15.00 cm
Flow Rate: 3000 (+/- 100) ml/minute
Relative Humidity: 70%
Challenge Gas: hydrogen sulfide
Challenge Gas Concentration: 10 (+/- 0.25) PPM

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