Water reclamation plant operators know two important facts about handling, storing, and dewatering biosolids: first, when biosolids are dewatered, odors are released. Second, they know that by adding permanganate to the biosolids, the odors are eliminated in minutes.

Minimally, released odors create a nuisance for surrounding neighbors and an unpleasant workplace. At their worst, volatilized odor compounds are dangerous and corrosive. For over 25 years, operators have used permanganate chemistry to solve these problems. Figure 1 is an example of a typical “Permanganate Treatment Curve” for controlling atmospheric H₂S during mechanical thickening and dewatering.

This curve will vary slightly, moving up and down, depending on the condition of biosolids, such as age, the percent solids, sulfide content and blend of primary and secondary.

Beyond successful odor control during dewatering, there are additional benefits to permanganate treatment. Reports from field trials, backed by research in the Carus Laboratory, show that permanganate’s oxidation potential raised the potential of the biosolids, making the dewatering polymers work more effectively.

Figure 2 illustrates a plant’s experience of testing their biosolids dewaterability using Specific Resistance measurements with various treatment combinations.
During actual full scale usage, here is what we learned from just a few of our customers. Additionally, here is what a plant in the southern U.S. found when they struggled with severe odor generated during dewatering 110,000 gallons/day of primary solids:

![Graph: Permanganate Eliminates Hydrogen Sulfide](image)

**Figure 3: Hydrogen Sulfide Removal**

With the permanganate treatment, the hydrogen sulfide levels above the belt press, that had been averaging 555 ppm, dropped to 2 ppm almost immediately. The polymer usage went from 75 lb/day to 33 lb/day, a savings of about $10,000 per year.

**PLANT #2 RESULTS**

A New Jersey facility writes, “A potassium permanganate feed system is provided to allow injection of potassium permanganate into the digested sludge feed upstream of the Digested Sludge Thickening/Dewatering Building wet well. Injection of potassium permanganate reduces sulfide concentration in the sludge and improves thickening/dewatering characteristics of the digested sludge feed. The filtrate and the wash water collected from the Gravity Belt Thickener/Belt Filter Press flows by gravity back to the head of the treatment plant.”

Here’s an example of polymer savings. A wastewater treatment plant feeds potassium permanganate to control hydrogen sulfide emissions during dewatering. Dewatering data was collected and is shown below:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>No KMnO₄ Treatment</th>
<th>KMnO₄ Added</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Polymer Dose</td>
<td>8.258 lb/ton</td>
<td>4.508 lb/ton</td>
</tr>
<tr>
<td>Average Permanganate Dose</td>
<td>0.0 lb/ton</td>
<td>1.055 lb/ton</td>
</tr>
<tr>
<td>Solids Recovery</td>
<td>97.91 %</td>
<td>97.80 %</td>
</tr>
<tr>
<td>Cake Solids</td>
<td>28.18 %</td>
<td>30.69 %</td>
</tr>
</tbody>
</table>

**Figure 5: Dewatering Data Table**

The plant found that by feeding 1 lb/ton KMnO₄, the polymer usage was lowered by 45% while the cake solids increased by 8.9%. With no permanganate treatment, the polymer cost was $14 per dry ton. With permanganate added, the combined permanganate and polymer treatment cost was $9 per dry ton.
At a small, two million gallons per day (MGD) Illinois treatment plant, biosolids are collected and dewatered 3 times each month. The average monthly biosolids volume is 144,000 gallons. When processed, the biosolids are 2-3% solids and they are dewatered at a 100 gpm rate.

While storing during off-days, the solids become septic. When dewatering begins the H₂S levels above the belt press reach 55-85 ppm. Injecting CARUSOL® liquid permanganate into the raw solids pipeline before the belt press, the sulfides are lowered to 15 ppm above the press and to 0 ppm in the room. The optimum permanganate dosage is 100-120 mg/L.

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There are also reports from European treatment plants. In one case, a 5.7 MGD treatment works is located in a holiday and resort area. Fugitive odors could not be tolerated. Blended primary/secondary biosolids are thickened and dewatered using centrifuges at a flow rate of 26 gpm, 10 hours/day. The dewatering room is vented to a bio-filter scrubber.

The biosolids are septic and during dewatering high hydrogen sulfide emissions and dangerous working conditions result. Operators reported eye irritation from H₂S exposure. Nuisance odor complaints due to the biofilter exhaust were common.

To solve the problems, CAIROX® potassium permanganate solution is injected into the raw biosolids pipeline leading to the centrifuges. The optimum dosage was determined to be 10 lb KMnO₄ per hour, when the centrifuges are running. Hydrogen sulfide levels dropped from 75-150 ppm to non-detected in the room, protecting the workers. The bio-filter exhaust also dropped from 20 ppm to non-detected, satisfying the neighbors.

These are just a few of the hundreds of successful cases of permanganate used for biosolids treatment. Importantly, CARUSOL liquid permanganate and CAIROX potassium permanganate will:

• Eliminate odors caused by hydrogen sulfide, organo-mercaptans, organo-amines and other unpleasant volatile odor compounds
• Act fast and efficiently
• Improve the biosolids cake dryness
• Lower the polymer requirement

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Try it at your plant. Contact Carus Corporation for additional information. Send us an email to salesmkt@caruscorporation.com or call us at (815) 223-1500.