



BRI bio-oxidation system on a plywood press

Bio-oxidation

A pollution solution from the earth for the earth

By Val Maloney

It is no secret that environmental issues are on everyone's mind and people in the wood industry are no exception. The Environmental Protection Agency (EPA) in the U.S. has introduced Maximum Achievable Control Technology (MACT) standards for the reduction of emissions and, according to industry insiders, legislation in Canada is also in the works. The question then lies with companies on just how they are going to meet these standards. One of the options is bio-oxidation which, simplified, is a technology based on microbes that can remove both water-soluble and non-water soluble emissions from the air when it is passed through the bio-oxidation system.

Environmental standards

MACT rules have been in development by the EPA with input from APA-The Engineered Wood Association for quite some time, says Lisa Bailey, a research technologist with the APA in Tacoma, Washington. The rules fall under the Clean Air Act in section 112, and establish standards requiring the maximum degree of reduction in emissions of hazardous air pollutants. Set at 90 percent removal of

hazardous air pollutants (HAP's), the number was arrived at by looking at the dose and toxicity of the emission and calculating the risk it posed to the nearest person, called "compliance based on risk." While MACT standards are now in place, industry and the EPA are currently working on what is being called MACT two, following a court decision in a lawsuit by the National Resource Defense Council who said the risk option was not legal.

History and design of bio-oxidation systems

Bio-oxidizers are one way for companies to comply with these rules and control emissions and Bio-Reaction Industries in Tualatin, Oregon manufactures these systems. Karl Mundorff, President and CEO, says the main reason the company began making the systems was "energy conservation and lowering the carbon footprint." The first applications of bio-oxidation began in the 1960s and were largely on odor control and wastewater treatment plants, says Dr. Jim Boswell, senior scientist with Bio-Reaction Industries. In the 70s and 80s, European countries, especially Belgium, Germany and France, began using the technology on commercial and industrial applications. The technology started being used in the US during the late 1980s. Bio-Reaction installed its first unit, a 40,000 CFM multi-stage particleboard unit in Oregon,

in 2001 and is currently installing 10 systems designed to meet MACT standards, says Boswell.

Bio-Reaction Industries has modified its bio-oxidation units from the original design, explains Boswell. The microbe system consists of three stages, the bio-trickling filter, bio-matrix chamber and sump. The bio-trickling filter makes up one-third of the system's size and media. This stage houses cross-flow media that has an open design to promote uniform distribution of the air. The media also supports microbial growth. This first stage is where the simple compounds that are easy to break down, such as alcohol, are eaten by the bacteria. Like us, says Boswell "the bacteria prefer to eat things that are easy to digest and not that good for them, so it's best to get them out of the system in the first stage so the more complex things can be eaten in the second stage of the process."

The second stage known as the bio-matrix chamber makes up the other two-thirds of the system and is where more complex compounds such as terpene, pinene and benzene are consumed by the microbes. The time it takes for the microbes to destroy more than 90 percent of the compounds can be as little as eight seconds for water soluble compounds. On tougher compounds it can be 20-45 seconds for 75-85 percent destruction. This stage where tougher compounds are disposed of is made of Bio-Reaction Industries' patented structured biospheres. These spheres are filled with compost and provide a medium where the biological colonies can reside because of the mulch that has micro-nutrients to keep the microbes healthy.

The third part of the bio-oxidation system is the sump, which continuously re-circulates water throughout the system through the cross-flow media that humidifies and removes water-soluble compounds.



Bio-Reaction Industries President and CEO Karl Mundorff

"Our system is very simple to use. We can save a company up to 66 percent on their maintenance costs and on their pollution control costs."

What makes bio-oxidation different?

Bio-oxidation differs from other emission reducing systems such as thermal oxidation because there isn't a need for natural gas to heat the device. "MACT standards say you have to degrade 90 percent of the hazardous air pollutants (HAPs) and we do it without burning natural gas," explains Mundorff. "A company can say we want to put in a thermal oxidizer to treat the HAPs and thermal oxidizers do a very good job of that. They also cost a lot in operating expenses because of the natural gases used to heat the devices. They need a high temperature to burn/combust the HAPs. We can save a company all of that operating

cost and also, by not combusting natural gas, we are not creating greenhouse gases. There is an environmental footprint we are reducing that the company wouldn't have if they didn't go with us."

David Word, program manager at the National Council for Air and Stream Improvement Inc. in Florida, agrees that bio-oxidation systems are more economical for businesses and better for the environment because they don't require natural gas. "They don't require regenerative thermal oxidizers, a form of incineration which needs a heat source to bring up the temperatures and oxidize them," he says. "Bio-filters still use energy to make the air run through the sys-

tem although they don't require fossil fuels to provide air for oxidation. "Bio-oxidation systems are better for cleaner air and carbon dioxide. They don't emit carbon monoxide and they can help to reduce the levels of carbon monoxide in the air because of the bugs that live in them." "To illustrate this point, Boswell said that a 100,000 ACFM thermal oxidizer would cost a plant one million dollars in natural gas per year." "It would also cost 40-60 tons of NO_x, and several thousand tons of CO₂ per year," he says. "When you use a bio-oxidizer there is an 80 percent reduction in CO₂ and no NO_x, SO_x or CO are emitted."

Bio-oxidizers also require a lower level of maintenance over time, says Mundorff. "Our system is very simple to use. We can save a company up to 66 percent on their maintenance costs and on their pollution control costs." Boswell recommends adding a nutrient additive to the system, basically a fertilizer, so that the microbes don't run out of nitrogen on a weekly basis. This is added to the sump of the system and re-circulated throughout the entire process.

A choice for the long haul

ATC Panels is installing a 150,000 ACFM bio-filter from Bio-Reaction at their Franklin, Virginia plant, says corporate technical director Bruno Gorrini. They heard about bio-oxidation at composite panel meetings where MACT legislation and possible solutions were being discussed. He says they decided to use bio-oxidation over other system options because of the low operating cost, low maintenance and lack of gas consumption that bio-oxidation systems offer.

Freres Lumber in Lyons, Oregon also had a 50,000 ACFM bio-filter from Bio-Reaction installed on their plywood presses because the operating costs are lower and the machines are more environmentally friendly due to the fact that they don't burn fossil fuels. "We chose Bio-Reaction because they were recommended to us," says vice-president Kyle Freres. "They could meet our time frame and are a local north-west company." He also stressed the importance of the lower carbon footprint of the system, saying "everyone is becoming more environmentally conscious. People who are proactive are appreciative that we implemented measures and they realize that the companies that implement measures to combat pollution are the ones that are going to be around for the long haul." SWJ