

From landfill to the tomato plant – purified biogas powers greenhouse operation

Contributed by Eco-Tec

The Board of Waste Management for the Mauricie region of Quebec, Canada, known as RGMRM, needed a gas scrubber to remove the highly corrosive levels of hydrogen sulfide (H_2S) at its municipal landfill.

The aim was to purify the landfill gas for a greenhouse on site, which also is RGMRM's customer. The gas was to be converted into a usable source of heat for the greenhouse, especially during the winter months, and into a source of CO_2 to enrich the hydroponic tomatoes grown there. In turn, the renewable source of carbon dioxide, present in the biogas, would eliminate the costs associated with having to purchase and maintain CO_2 for the operation.

In 2009, RGMRM found a solution through an Eco-Tec Inc. system known as BgPur, which uses a patented, high efficiency gas-liquid contacting process, allowing H_2S to be absorbed and the gas purified for reuse in power generation, cogeneration and heating applications. Today, the BgPur system continues to successfully remove more than 99 percent of hydrogen sulfide from the gas at RGMRM's landfill, for reuse in its internal processes. Located among the Laurentian Mountains, RGMRM is the board of management of waste for the Mauricie region of Quebec, Canada, which has a population of approximately 300,000 people. The public body was formed through an

amalgamation of several municipalities entrusting it to manage the region's waste. RGMRM's mission includes respect for the environment, sound management principles and a focus on innovation.

It was RGMRM's first partnership with fellow Canadian manufacturer, Eco-



Figure 2. An RGMRM installation

Tec Inc., located in Pickering, Ontario. Eco-Tec's in-house Research and Development facility has been building industrial purification solutions since 1970, and has installed more than 1,500 systems in more than 55 countries.

Requirements

RGMRM needed a landfill gas scrubber that would remove H_2S and allow the gas to be used as a source of heat and CO_2 for a 540,000 sq. ft. greenhouse on site. The volume of saturated landfill gas extracted from the wells is 3,085 Nm^3 /hour, at a maximum temperature of 40°C and with an H_2S concentration of 50 ppmv.

The greenhouse specified that the gas needs to be provided to them with an H_2S concentration of less than 1 ppmv and dried to a maximum dew point temperature of 3°C.

Solution

The BgPur system was designed for the client to handle the complete flow through two single contactors to remove the H_2S down to the required level. The purified gas is compressed (to 1 barg) and then chilled to meet the greenhouse's requirements.



Figure 1. The washed solid crystalline sulfur produced by BgPur is pure sulfur, which can be used as an agricultural supplement and resold as a valuable commodity by the client.

This specific BgPur configuration – which features two contactor tanks rather than one – was installed for RGMRM because of the large volume of gas coming from the landfill (3,085 Nm³/hour). Each contactor can handle about 1,500 Nm³/hour.

The overall system eliminated the need for 9 million m³/year of natural gas and, as a result, reduced Greenhouse Gas (GHG) emissions by approximately 135,000 tons of CO₂ for the client. The H₂S in the treated gas is less than 1 ppmv, and generally below the detection limit of 0.2 ppmv more than the entire inlet concentration range.

System

The H₂S scrubber system is designed with a patented mass transfer technology that allows the H₂S to be absorbed into solution where the chemistry converts it into elemental sulfur. The system takes advantage of the oxygen present in landfill gas, which regenerates the absorption chemistry at the same time. The elemental sulfur floats to the surface as a froth/foam where it overflows into a slurry thickening section. The slurry is pumped to a filter press which removes the solid sulfur and returns the filtrate back to the contactor for a fully closed-loop process.

The filter press provides a 60-65 w/w sulfur cake, which is greater than 99 percent sulfur. The washed solid crystalline sulfur produced by BgPur is pure sulfur, which can be used as an agricultural supplement that can be resold as a valuable commodity by the client.

For RGMRM, the system also delivers a simple design and operation with no packed columns, allowing continuous reliable operation without any column to plug, foul or foam;

and no labor for media cleaning or replacement. The system arrived factory constructed with a compact design, which provides a small footprint, short delivery and low installed costs. The automated control system detects response to changes in gas flow-rate or H₂S composition and supplies automatic reagent addition.

As well, there's no waste resulting from the operation, only environmentally acceptable solid sulfur cake, which means no additional waste treatment equipment or operating costs are needed; and no disposal of potentially hazardous media. 🌱

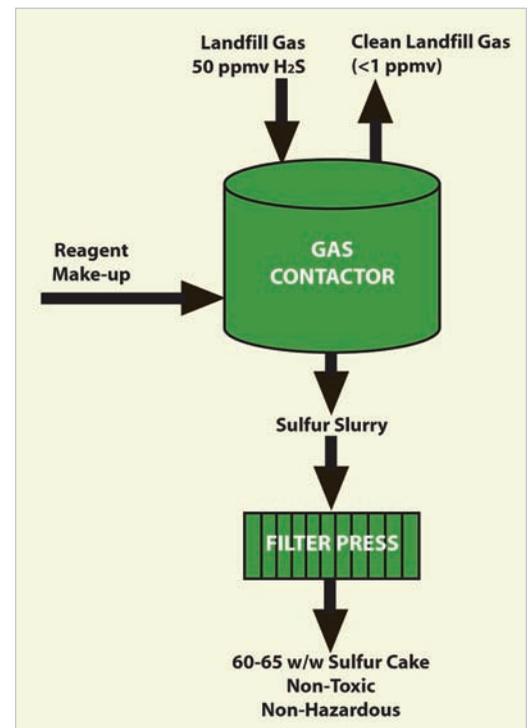


Figure 3. Single contactor schematic

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- Energy recovery/biogas utilization
- Renewable energy source
- Energy cost reduction
- Waste-to-energy



- Turnkey systems
- Ease of operation
- Maintain site footprint
- Reduce carbon footprint



- Increase process volumes
- Reduce operating costs
- Reduce GHG emissions
- Eliminate odors



- Treatment quality to:
 - Meet stringent regulations
 - Permit reclamation/reuse
- Eliminate/reduce solids disposal costs
- Waste digestion



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