

Biological Waste Gas Treatment of Odors from a Vegetable Oil Production Plant

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Introduction

A seed extraction production plant producing vegetable oil products emitted a gas containing several compounds like H₂S, hexane, and 2-methylpentane. The characteristics of the waste gas were quite extreme: up to 16,300 ppm H₂S, 140 °F, and almost 0% oxygen. The waste gas was diluted in order to achieve biologically acceptable conditions. Since the regulations demanded a certain level for H₂S a biological treatment bioreactor, was applied.

Purspring™ bioreactor

The bioreactor operates with the process water recirculated at the top layer. Nutrients and fresh water are added to the other layers. The system is controlled by electro conductivity (EC at 50-55 mS/cm) and by pH (pH at 1.1-1.3).



H₂S removal

The amount of H₂S present in the waste gas depends on the type of seeds being processed: the extraction of rapeseed results in much higher H₂S concentrations than extraction of soybeans. Most of the time processing of rapeseed occurred resulting in very high H₂S concentrations. The removal efficiencies for H₂S were over 98% (figure 1). Early 2002, the process switched between rapeseed and soybeans every two to three weeks as is shown in figure 2.

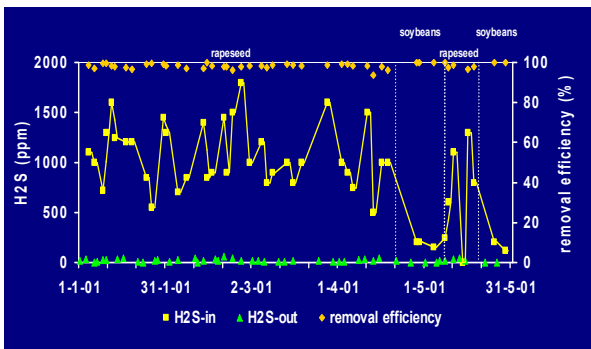


Figure 1: H₂S removal efficiencies at 940 cfm

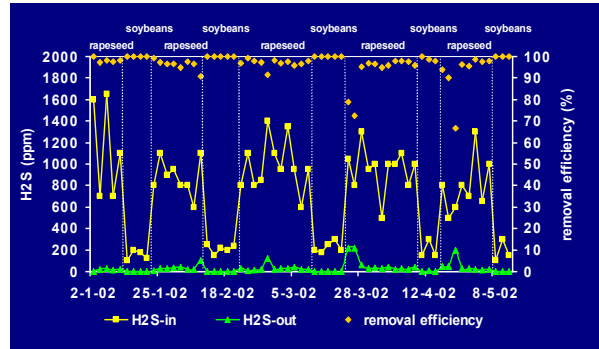


Figure 2: H₂S removal efficiencies during frequent changes in type of seeds processed at 910 cfm

VOC removal

VOCs of the extraction process were removed at an efficiency of 60% (table 1). This was higher than expected since the operational pH of the bioreactor was very low, pH 1.3. The VOCs at the given concentrations did not negatively affect the bacteria involved in H₂S oxidation since the removal efficiency was very high. Moreover, the Purspring™ bioreactor contains micro-organisms that can degrade the VOC compounds of the extraction process.

Table 1: In- and outlet concentrations and removal efficiencies for VOCs at 838 cfm and 1,800 ppm H₂S

Compound	Concentration in mg/m ³	Concentration out mg/m ³	Removal efficiency %
Hexane	107	40	63
2-methylpentane	131	55	58
3-methylpentane	66	26	61
Methylcyclopentane	23	8	65
Total VOC	327	129	60

Conclusion

The Purspring™ bioreactor showed an excellent removal efficiency (> 98%) even at high and fluctuating H₂S concentrations: 200 – 1,800 ppm. The H₂S-oxidizing bacteria were not influenced by the presence of hexane and 2-methylpentane. These and similar compounds were biologically degraded to an extent of 60%.