Poster # 4

A Storm in a Tea Cup – Practical Aspects of VHP Room Fumigation

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Objectives
Room fumigation has traditionally been performed using formaldehyde. However, recently new methods have been developed amongst them vaporised hydrogen peroxide (VHP). VHP offers a number of advantages, such as degradation into non-toxic compounds (environmentally friendly), being non-corrosive (if used properly), leaving no residues and being a vapour. On the other hand, it also poses new challenges in that the equipment is expensive (compared to formaldehyde), VHP has to be properly distributed inside the room and fumigation cycles need to be developed for each individual room. These challenges can be overcome as many laboratories have shown.
With this presentation we would like to highlight important engineering requirements that should be kept in mind when designing new or refurbishing existing facilities for VHP room fumigation while also showing that different approaches may be used to achieve satisfying fumigation results. Furthermore, we would like to introduce a new system for dispersing VHP inside the rooms (DekoJet, Alpiq 6100). This system allows for more efficient distribution of VHP, thus reducing condensation and cycle times. Results from numerous fumigations at two different institutions will be presented, underlining the effectiveness of the distribution system.

Methods
HEPA filter boxes, rooms, airlocks and pressure relieve systems were fumigated using VHP. Fumigations were performed independently at two different institutions using the same system and same principles, however on differing engineering set ups.

Results
VHP fumigation may be performed on very different fumigation enclosures. One key factor for a successful fumigation is the proper distribution of the vapour within the enclosure. Two systems that are based on the same principle but adapted to different engineering set ups were shown to give excellent results while reducing cycle times and condensation.

Conclusions
VHP is proven to be a versatile system that may be adapted to very different fumigation zones. However, certain aspects need to be kept in mind, foremost amongst them the distribution of VHP.

Outcomes
Use of a well thought through distribution system for VHP is key to a successful fumigation.









Figure 1: Bringing VHP into the fumigation zone is the first important step of any fumigation cycle. This can be done in different ways. The top pictures show a set up with dedicated fumigation lines leading directly into the room, while the bottom pictures show a distribution system leading into the supply air ducts. In both cases, insulation of supply lines is essential. However, smaller lines can be more easily pre-heated, thus reducing the risk of condensation. Supply air ducts may be more difficult to pre-heat and often require additional heating on besides insulation. In this case supply air ducts were additionally fitted with heating coils to achieve higher surface temperatures in the ducts in order to control condensation.



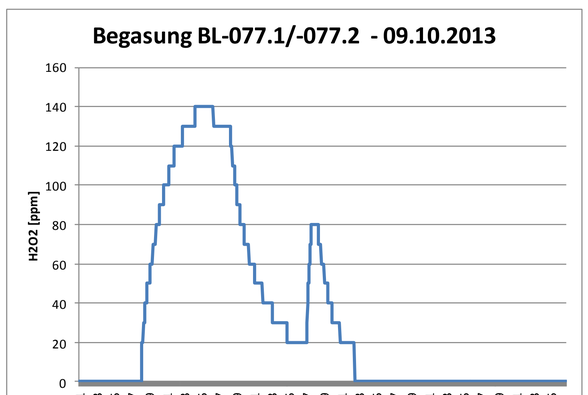

Figure 3: Condensation is one of the most important problems people are faced with when setting up VHP fumigations. The two pictures on the left-hand side show epoxy coatings that started to blister and peel due to VHP. The top right picture depicts blistering in the air vents shown in Fig. 2 (bottom left picture). VHP could not be efficiently collected at the air vents by the DekoJet leading to a saturated VHP environment inside the vents and thus to blistering of the epoxy.
The graph on the right shows the logger data of a fumigation performed at SPIEZ LABORATORY. Shown are H_2O_2 concentrations over time. The second peak appeared once the ventilation system was turned on to purge the room. Evidently, the repeated increase in the H_2O_2 concentration is due to prior condensation in the supply air ducts (the room is situated two floors below where the VHP generator stands). The effect shown here could be diminished with the installation of heating coils and insulation of the supply air ducts.

Figure 2: Distribution of VHP inside the fumigation zone is key to a successful fumigation. Besides achieving a uniform VHP concentration over the whole zone and thus complete and efficient kill at all spots, this will reduce the risk of local pockets with high concentration and condensation which in turn can cause damage to epoxy coatings (see also Fig. 3)or equipment (especially electrical equipment) and will furthermore reduce fumigation cycle times.
We propose the use of high performance ventilators to create "a storm in a tea cup". The top pictures show the Alpiq 6100 which takes the VHP directly from dedicated supply lines and accelerates the flow from approximately 34 m^3/h supplied by the VHP generator to a maximum of 2000 m^3/h thus assuring efficient and uniform distribution throughout the fumigation zone. The bottom pictures depict the DekoJet which is based on the same principle but collects the VHP at the supply air vents.
Clearly, the approach depicted at the top is to be preferred as this poses a decreased threat of condensation, but the second set up can be made to work as well (see also Fig. 4).

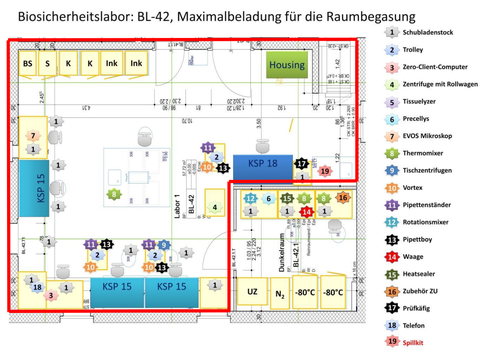

Figure 4: The room depicted on the left, which has a volume of around 180 m^3, was fumigated with four BSC class 2 and an isolation rodent cage rack system running. The room with all the equipment as well as the above installations can be fumigated (validated). Because VHP is supplied via the air ducts, only low injection rates could be used (risk of condensation), thus prolonging cycles times. 110 biological and chemical indicators were placed in the room (as well as temperature/humidity and H_2O_2 data loggers) and inside the equipment per run and complete kill could be achieved.
The lab shown on the right is fumigated as a whole (red square), contains 6 BSC class 2, has a volume of roughly 280 m^3. A log 6 reduction was achieved in all pertinent spots

Conclusion: VHP is a versatile fumigation system which may be adapted to very different technical and architectural set ups. However, it is important to keep the following points in mind:

- Condensation in the supply lines needs to be avoided
- Condensation inside the fumigation zone needs to be avoided
- Rapid and uniform distribution of VHP inside the fumigation zone is key to a successful fumigation

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