THE NEED TO USE PURIFIED CARBONYL SULFIDE (COS) TO PREVENT CORROSION OF COPPER

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Introduction

Carbonyl sulfide (COS; COSMIC®) is a potential alternative fumigant for stored products. However, before a fumigant can be used to disinfest commodities or facilities**,** possible negative effects, such as altering the properties of materials, must be ruled out. Copper is an important material in this regard, as it is present in electronic and other equipment that may be exposed during fumigation. This corrosion study on copper was conducted using both unpurified and purified COS.

Experimental conditions

The relative humidity and temperature were set up at 72±3% and 25±2°C. Normally, fumigation is carried out at relative humidities of < 70%. Here a worst case scenario was tested because, for common commodities, such as wheat, barley, sorghum, paddy and maize, their moisture content is 13.5-14.5% (wet basis) in equilibrium with a relative humidity of < 70.0% at 25°C. Carbonyl sulfide was dosed at the concentration of 100 mg/L, a level of COS is substantially higher than the concentration required for control of stored product insects. Tarnishing of copper pieces was assessed in blind tests by 12 people. Concentration of COS in the headspace was measured over 48 hours to detect any conversion or adsorption of COS.

Results

The results show that only the copper pieces that had been exposed to unpurified COS, had a strong discoloration, a dark blue hue. Only 4/12 people identified a slight color change between the untreated samples and those exposed to purified COS. These results indicated that the tarnishing of the copper pieces was result of H_2S contamination rather than COS itself at 25°C and 72% r.h.

The concentration of COS in the headspace over the copper pieces remained constant (Figure 1). This result indicates that COS was not degraded to H_2S or absorbed by copper pieces at 72% r.h and 25°C.

Conclusion

It is very important to use purified COS to prevent corrosion. When purified COS is applied, corrosion will not occur, even at high humidities (72%). The degradation of pure COS at high relative humidity is too slow to form corrosive hydrogen sulfide (H_2S) (Figure 1). This result suggests that COS for direct use as a fumigant must be manufactured to eliminate contamination (to <0.05%, v/v), or the fumigant scrubbed of H_2S before application on site. Indeed, very low contamination of COS by H_2S is a specification for the commercial product, COSMIC®.

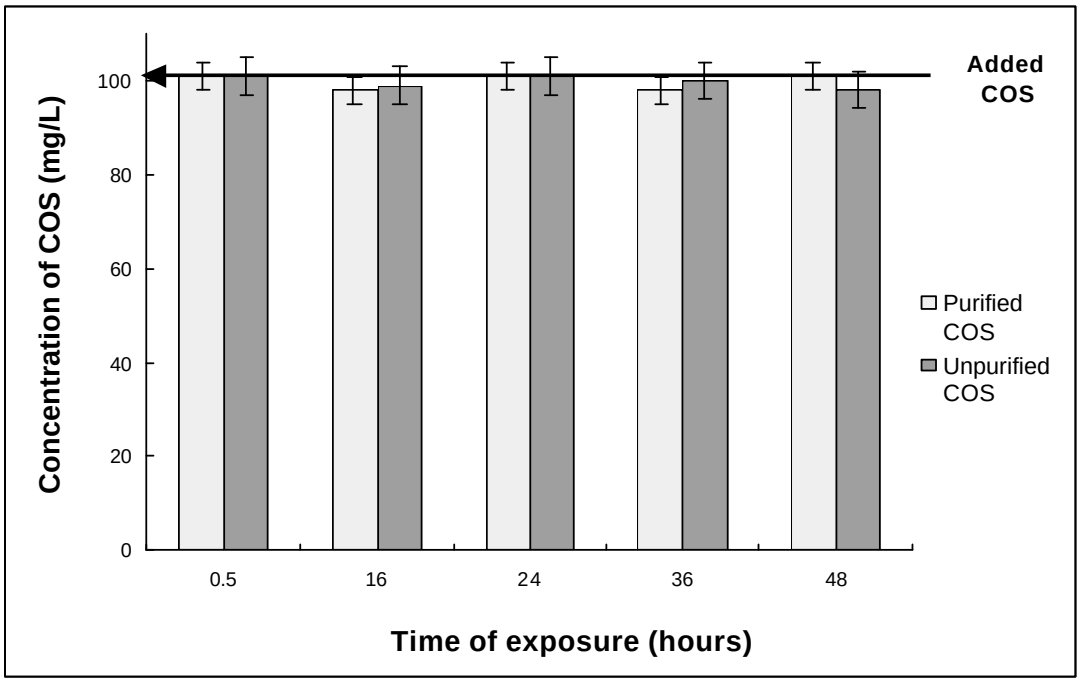

Figure 1. The concentration of COS in the headspace over the copper pieces remained constant. This result indicates that COS was not degraded to H_2S or absorbed by copper pieces at 72% r.h and 25°C.