SORPTION OF CARBONYL SULFIDE BY STORED PRODUCTS

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When using fumigants commercially it is not enough to know what concentration of fumigant is needed for how long, it is also necessary to know or determine how much fumigant must be applied to a commodity to achieve that concentration for the desired time.

While leaks are often the most significant cause of fumigant loss during fumigation, the concentration of fumigant also declines due to sorption of the gas by the commodity. As sorption can be significant and is a predictable loss, it should be taken into account prior to fumigation. An understanding of the factors that contribute to sorption help the user apply appropriate amounts of gas and therefore avoid fumigation failure and/or the development of insect resistance.

The sorption of COS by a range of commodities was investigated at 25°C, 60% r.h. and 40% fill. In general, the observed loss of COS from the headspace followed the general equation, $C_t = C_0 e^{-kt}$, where t is the time elapsed in hours, C_0 is the initial concentration, C_t is the concentration at time t, and k is the rate of sorption. The rates of sorption for the commodities tested are listed in Table 1. Of these, kidney beans and sunflower seeds were found to be highly sorptive and are probably unsuitable for fumigation with COS.

The effect of moisture content on COS sorption, was investigated on soft wheat. It was found that as the moisture content was increased, the rate of sorption also increased. COS was found to be less suitable as a fumigant of grains at moisture contents higher than 15% (Figure 1).

The age of commodity and history of previous fumigation with COS were also investigated on soft wheat. Increasing storage time appeared to reduce the rate of sorption as did the number of times that a commodity has been previously fumigated with COS.

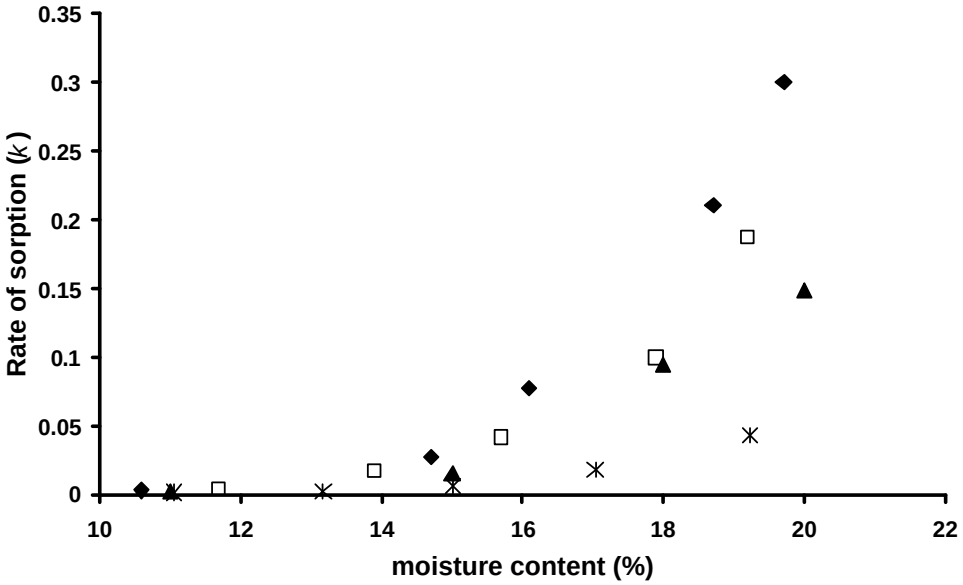

Figure 1. The effect of moisture content and storage time on sorption of COS by wheat (cv "Diamondbird" fumigated 1 week post harvest (◆), after 6 months storage (□), after 18 months storage (▲) and cv "Rosella" wheat after >3 years storage (✳)) fumigated at 25°C.

Table 1. Rate of sorption (and regression coefficients) calculated for commodities fumigated with COS at 40% fill rate, 25°C.

Commodity	Rate of sorption (*k*)	R^2	Commodity	Rate of sorption (*k*)	R^2
Almonds	0.0192	0.957	Red kidney beans	0.0421	0.978
Barley	0.0037	0.989	Rice (brown)	0.0084	0.999
Canola	0.0053	0.993	Rice (paddy)	0.0089	0.998
Cardamom (whole pods)	0.0034	0.995	Rice (white)	0.0044	0.978
Chick peas	0.0103	0.958	Safflower	0.0124	0.997
Chilies (dried)	0.0043	0.990	Sorghum	0.0091	0.998
Cocoa beans	0.0034	0.971	Sorghum (white)	0.0129	0.992
Coffee (Arabica)	0.0041	0.950	Soya beans	0.0158	0.997
Cotton seed (fuzzy)	0.0213	0.990	Sunflower seeds	0.0395	0.988
Linola	0.0180	0.996	Wheat (soft)	0.0052	0.988
Lupins	0.0079	0.992	Apricots (dried)	0.0003	0.057
Maize (feed)	0.0174	0.997	Peaches (dried)	0.0006	0.450
Maize (soft)	0.0121	0.989	Pears (dried)	0.0002	0.038
Mung beans	0.0185	0.990	Sultanas (processed)	0.0004	0.264
Oats	0.0047	0.988	Sultanas (unprocessed)	0.0004	0.169
Peas (field)	0.0049	0.994			