TARP PERMEABILITY TESTING AT EPA

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EPA has established risk management measures to reduce the potential for exposures from soil fumigants to agricultural workers and bystanders. Buffer zones around the treated fields are one of these measures. EPA has used the concept of credits to reduce buffer distances if techniques that reduce emissions are utilized in the process of application. The Agency currently allows buffer distances to be reduced if certain types of less permeable films, as opposed to the more common low or high density polyethylene films which served as the basis for calculating the current buffer distances, are utilized. This approach has been based in large part on the availability of laboratory test results of Scott Yates and others that determine the mass transfer coefficient (MTC), a measure of how permeable an agricultural film is to a specific fumigant.

There are many types of films (or tarps) available in the marketplace and the permeability of the films varies widely with material type, manufacturing techniques, and manufacturer. Because of the lack of a standard method for classifying the available films according to their permeability and the limited available data (primarily generated by Scott Yates's group and Husein Ajwa (Yates, 2007; Ajwa, 2007) on the permeability of these films, it is currently difficult to systematically develop buffer zone credits on a wider basis for more films which could provide growers and applicators with more choices for managing the impacts of buffer distances in their daily operations. In order to address this issue, EPA has begun to test film permeability in one of its laboratories for several film/fumigant combinations.

As a result of this testing effort, the Agency expects to develop a testing protocol that provides reliable, reproducible measures of agricultural film permeability. The Agency is using the protocol developed by Scott Yates at Agricultural Research Service (ARS) of USDA as the basis for the testing. It will also provide for the availability of MTCs for commonly used agricultural films. The MTC is independent of compound concentration and is dependent only on the properties of the film, fumigant and the temperature. MTCs are used by the Agency to compare the relative performance of film/fumigant combinations with one another. The objective of this study is to establish a database of the MTCs for the commonly used films for various fumigants. The Agency will make the protocol available, on its website, that is used to develop the MTCs for the agricultural films that it will be testing. This will permit the Agency to calculate credits, as appropriate, from data generated in accordance with the protocol for films that have not already been tested/included in the database.

Various films are being tested for their permeability to a number of fumigants including, methyl bromide (MeBr), Iodomethane (IOM), 1,3-dichloropropene (1,3-D), dimethyl disulfide (DMDS), chloropicrin (PIC), and methyl isothiocyanate (MITC). The MTCs of the films are determined under laboratory conditions using stainless steel permeability cells as described by Papiernik et al. (2001, 2002). The recovery of the fumigants from the permeability cell, the reproducibility and variance of replicate testing are documented for this method. Examples of the preliminary results are provided.

References

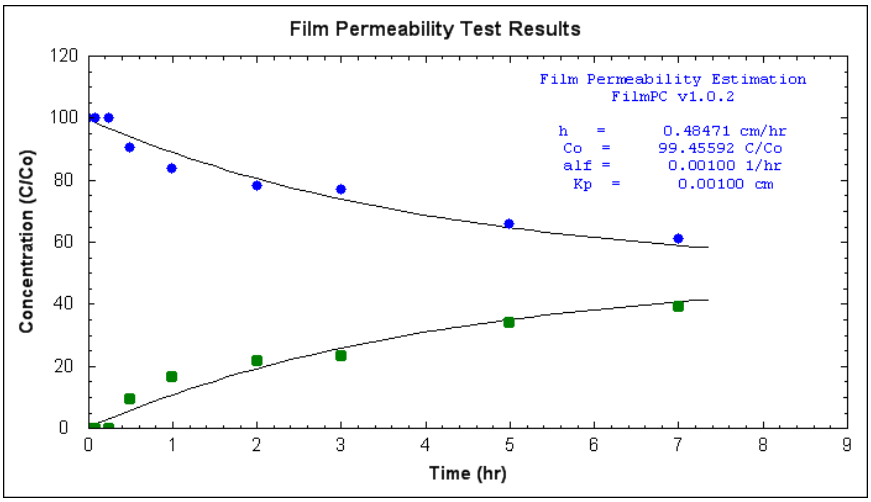
Ajwa, H., A. 2007. Testing film permeability to fumigants under laboratory and field conditions. 2007 Methyl Bromide Alternatives Outreach Conference.
Papiernik, S.K., Yates, S.R. and Gan, J. 2001. An approach for estimating the permeability of agricultural films. Environ. Sci. Technol., 35, 1240-1246.
Papiernik, S.K., Ernst, F.F., and Yates, S.R. 2002. An Apparatus for measuring the gas permeability of films. J. Environ. Qual., 31, 358-361.
Yates, S. 2007. Film permeability measurements in support of USDA-ARS Area-Wide Research. 2007 Methyl Bromide Alternatives Outreach Conference.

Table 1. Mass transfer coefficient (MTC, cm/h, 25^{o}C) of a semi-permeable film.

	MeBr	IOM	DMDS	MITC	(*E*)1,3-D	(*Z*)1,3-D	PIC
Rep 1	0.46	0.74	2.75	11.64	2.38	4.50	0.81
Rep 2	0.48	0.74	2.34	10.49	2.85	4.38	0.90
Rep 3	0.51	0.81	2.73	9.13	2.73	4.85	0.99
Average	**0.48**	**0.76**	**2.61**	**10.42**	**2.65**	**4.58**	**0.90**
STDEV	0.03	0.04	0.23	1.25	0.24	0.24	0.09
%variance	5.7	5.9	8.8	12.0	9.2	5.3	10.0

Representative Permeability regression charts

MeBr



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