BROMOTEC
ADVANCED FILM TECHNOLOGY FOR MODERN FUMIGATION DEMANDS

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LAWSON MARDON SMITH BROTHERS - A subsidiary of Alu-Suisse Lonza has been manufacturing high barrier gas impermeable film for methyl bromide ground sterilising for over 10 years.

The initial development of the film was carried out in the early 80's in response to the Dutch government's concern about air and water contamination in the Westland of Holland.

Tests were carried out in conjunction with the Institute for Land and Water Management, the Institute for Pesticide research and T.N.O. [1,2,3]

Following the successful conclusion of these tests, procedures were introduced with the force of law that required the use of impermeable film together with reduced MeBr dosage (from 100g/m2 down to 40g/m2).

This procedure was then used for the ensuing 7 - 8 years, and hundreds of tonnes of gas barrier film used successfully at these low dosages.

The technology required to manufacture high barrier films is considerably more complex than that used to make the standard single layer films. The technique employed is multilayer coextrusion which consists of using three or more extruders to melt and pressurise different polymers and force the polymers through a complex die to emerge as three discrete layers although in a single film. The film is then blown into a large bubble as for standard film. The advantage of this process is that it allows the best properties of the polymers to be combined.

The control of this process is obviously much more complex than when a single layer is involved particularly in the manufacture of gas impermeable sheeting.

The chemistry/physics of impermeability is based on the rate of transport of a gas or vapour through the polymer molecular structure. This will depend on may parameters but basically each polymer will provide a barrier to a particular gas. There is often a relationship between the permeability to different gases but this is not totally reliable. We have selected a particular polymer in this case in the core layer to be particularly impermeable to MeBr. (If other gases are used then other polymers are available).

In addition to the product requirements there is a major

requirement for consistency. Since the permeability is dependant on thickness it is obviously vital that the thickness of the layer providing the barrier is accurately controlled, other properties such as mechanical strength, puncture resistance must also be carefully monitored.

The principal business of L.M. Smith Brothers is food packaging films. Probably because of familiarity most people consider these types of film to have a relatively low technical basis.

The problems of the food industry are however on the contrary extremely complex, and protecting the package contents from oxygen, water vapour, taint, contamination and physical damage is a demanding task.

The technology that has been developed in this market is directly applicable to the manufacture of high strength, highly impermeable film for the fumigation business.

Control of gauge of the barrier layer is critical and needs to be controlled within 2 microns (1\10 the thickness of a human hair). There are two areas of gauge to be considered; average gauge and spot gauge.

State of the art coextrusion equipment such as is used to make Bromotec, now monitors gravimetrically the polymers going into the extruders, and since what goes in must come out, the ratio of the individual layers can be accurately controlled. This effectively controls average layer thickness.

Localised thin spots can be just as detrimental providing an escape route for the gas and hence reduced concentration of fumigant in that area. Fortunately the process itself is not subject to major changes during running and it is feasible to examine layer distribution round the bubble by using a cross sectioning technique combined with microscopy.

Sophisticated equipment, extensive quality control, statistical process control will all be required to ensure consistent performance.

Detailed studies in Israel, France, Spain, Belgium, U.K. and Italy have, now proved that it is feasible to reduce dosage levels by up to 50% when using barrier sheet. Effective use of polymer and film technology allows the concentration/time factor to be kept above the critical level.

Although the bulk of the work has been carried out on MeBr studies it is certain that advanced film technology will be required to provide a gas barrier regardless of the type of fumigant in use, if we are to protect the operators, and reduce or eliminate harm to the environment.

1. Emissiemetigen bij bodemontsmetting met methylbromide BIJDRAGE TOT EEN VERGELIJKEND VAN EEN ZESTAL AFDEKFOLIES
(Emission measurements on ground sterilising with methylbromide a comparison of six covering films)

C Huygen and F W van Ijsel report no: G1166 October 1982. T.N.O. HOLLAND.

2. USE OF GAS TIGHT PLASTIC FILMS DURING FUMIGATION OF GLASSHOUSE SOILS WITH METHYL BROMIDE.

Significance of permeation and leakage for the emission into the outside air.
ACTA HORICULTURAE 152, 1983.
H De Heer, L.M.G.Th Tuinstra, R Hamaker, A.M.M. van der Burg.

3. USE OF GAS TIGHT PLASTIC FILMS DURING FUMIGATION OF GLASSHOUSE SOILS WITH METHYL BROMIDE.

Effects on the Bromide - Ion Mass Balance for a Bolder District.
ACTA HORICULTURAE 152, 1983.
H De Heer, L.M.G.Th Tuinstra, R Hamaker, A.M.M. van de Burg.