9 Packaging of agrochemicals

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The Agrochemical Industry recognises the need for responsible and ethical care of its products from their invention through to ultimate use and beyond

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Viewed from a historical perspective, those engaged in development and selection of packaging for agrochemicals were interested primarily in getting products to the point of ultimate use at the lowest cost consistent with basic safety and shelf-life requirements. Since the mid-1980s and the substantial replacement of many metal containers by the new barrier plastics, attention has been focused on ergonomic issues at the point of ultimate use related to the transfer of product into application equipment. Latterly the fate of packaging ‘beyond’ ultimate use has dominated considerations in many parts of the world. Extensive collection schemes for recovery of conventional single-trip packaging have been created in several countries alongside the introduction of many returnable systems in appropriate markets. North America has taken a leading role in both approaches. Industry associations have been instrumental in addressing concerns on disposal and have agreed to cooperate and promote best practices through education and training.

This chapter will provide a guide to the mainstream packaging materials, methods of testing, design and performance considerations and conclude with a review of disposal practices and returnable systems. A glossary of technical terms is given at the end of this chapter, followed by suggestions for further reading.

9.1 Selection of packaging types

The essential prerequisite is that there is no interaction between packaging material and contents throughout the shelf life of the product.

9.1.1 Selection of packaging materials for solid formulations

Typical representative types of formulated products are

- wettable powders (WP);
- water-dispersible granules (WG);
• dusting powders (DP);
• granules (GR).

Polyethylene is the preferred material because it has universal application. It is thermoplastic, and therefore an ideal sealing medium, and forms a very good moisture barrier. The predominant requirement is the preservation of agrochemical formulations, particularly in humid climates. Flexible pouches or bags are preferable to rigid containers to minimize the amount of packaging used or to be disposed of when empty. If further strength is required, it can be obtained by the use of fibreboard outer packs.

In monolayer film constructions, a thickness of 0.1 mm will be sufficient in most applications. If shelf-life studies show the product to be very hygroscopic or water sensitive, an additional moisture barrier such as aluminium will be required. Aluminium composite foil requires a heat-sealable inner layer and external protection against environmental influences. In addition, physical strengthening and a print carrier are required.

A typical composite foil would consist of

• 40 gsm low-density polyethylene (LDPE) as the sealing medium;
• 0.012 mm aluminium;
• 20 gsm LDPE;
• one of the following:
  • 30 gsm polypropylene (PP);
  • 0.012 mm polyester (PET);
  • 0.015 mm polyamide (PA);
  • or 50 gsm paper.

Specific agrochemical formulation properties, e.g. a strong odour or volatile components, require a composite film which consists of LDPE and an additional barrier, not necessarily aluminium. PA or PET are ideal reinforcements for larger packages, e.g. 10–20 kg.

Typical constructions are

• 0.015 mm PA (external), which provides the gas barrier and physical strength;
• 0.050–0.100 mm LDPE (internal), which provides moisture protection and sealing.

The principle in designing multilayer films is to combine barrier properties. A comparison of LDPE, PA and a laminate of LDPE–PA illustrates this (Table 9.1).

Film or composite foil packages for powders or granules are usually tubular form–fill–seal (FFS) pouches, prefabricated bags or lined cartons. It is essential that seals are designed to minimize the retention of formulation after emptying and rinsing.