

Wool Testing Services Info-bulletin

Insect-resist treatments Permethrin on scoured wool

Introduction

Insect resist treatments are necessary where wool products are required to cope with insect attack. Since 1980, the active agent most commonly used has been **permethrin**, which is marketed under a number of trade names, including several formulations under the Bayer tradename of **Eulan™**.

Permethrin is a synthetic pyrethroid, and as such has low mammalian toxicity but is very toxic to fish and aquatic invertebrates. Used as a pesticide it has come under scrutiny and control in Europe and some other markets. Nevertheless it is still in very widespread use, from dermatological preparations to common household insecticides and textiles treatments. A cursory search reveals over 1300 products marketed in USA which contain permethrin. Permethrin is registered in Australia for use on vegetables, fruit, field crops and cereals.

Permethrin resistance has built up in Australian and New Zealand carpet beetles, resulting in searches for alternative IR agents, one of which is **Larvanil™**, developed by WRONZ, which uses a different active based on **bifenthrin** to minimize environmental issues.

Mothproofing specifications

The most commonly-quoted specification for products to be deemed insect-resistant appears to be Woolmark E10 (see box). This specification emphasizes that the application levels may need to be in excess of the minimum values quoted, since subsequent wet processes, cleaning and exposure to light can all reduce the level of active agent.

In view of the fact that only approximately half of the insect resist agent applied in raw wool scouring will survive subsequent processing, from both a cost and environmental perspective it makes sense to apply insect resist late in manufacturing.

Australian and NZ environmental labeling standards for wool pile and wool-rich carpets refer to Woolmark E10, and actually specify level 5 application, but forbid use of synthetic pyrethroids in scouring, or any insect resist in opening, carding or spinning. In other words, it must be applied at dyeing or later.

In Europe, attack by beetle larvae is uncommon and for Fernmark and Woolmark carpets only moth resistance is required. A new carpet must contain 58 ppm of permethrin (or 0.058% of a typical agent containing 10% permethrin) in the pile. This is twice the level required for protection to allow for losses due to shampooing and light exposure. The application level used for dyebath addition is typically 10 to 20% higher to reliably achieve the required level.

GuT-labelled carpets required 130 ppm to achieve beetle resistance but these requirements have now been relaxed. In New Zealand and Australia, because of the prevalence of beetles, 300 ppm of permethrin or 9.4 ppm of bifenthrin is required to be in the carpet after manufacture.

(thanks to Canesis for assistance with information in this bulletin)

Woolmark IR Specifications

Woolmark specification E10 covers insect-resist treatments. It forms the basis of the Chinese specification HJBZ 11 for "moth-resistant wools" and is widely quoted.

The specification has 5 levels of treatment. Level 1 is the basic requirement, Level 2 is advisory, Level 3 is mandatory for Woolmark products carrying the "Insect Resistant" claim sold in S Africa, Level 4 for products into Australia and Level 5 for products into New Zealand. Level 4 requirements are higher than level 5 for most actives in E10, although not in the Chinese specification. The minimum level of active agent is specified after cleaning and light fastness testing.

For example, for Eulan ETS-01, SPA-01 and WBP-01, the basic and advisory minimum is 0.035 w/w%, for levels 3 and 5 0.075 w/w% and the level 4 minimum is 0.181 w/w%. However, in order to take into account the fact that these levels are after cleaning & light fastness testing of the product, the application levels must be higher. To avoid fastness testing (Woolmark TM28), and for carpets, carpet yarn, rug yarn or upholstery fabric, a fastness factor can be used to estimate the resultant levels.

For application of the agent during raw wool scouring, for the three Eulan products mentioned above, the factor is 0.5. In other words, the minimum levels on scoured wool would need to be twice the values quoted – i.e. basic and advisory 0.07 w/w% (700 mg/kg), 0.15 w/w% (1500 mg/kg) for levels 3 and 5, and 0.36 w/w% (3600 mg/kg) for level 4.

Marks & Spencer allow mothproofing in carpets in accordance with Woolmark E10, but the products must comply with current UK legislation.

Environmental issues

As indicated, permethrin is still very widely used, but it comes under the European IPPC regulations. As a consequence, it has effectively been banned as a residue on scoured wool likely to be processed in Europe – the issue being that in all subsequent processing there is a good chance that residue will be released to water. The Environmental Quality Standard (EQS) for permethrin in UK freshwater or estuarine waters is 0.01 µg/L, which is exceptionally low.

The UK specifications are so tight that clean wool scoured after a plant has been washed down from a prior permethrin treatment could still be regarded as significantly contaminated.

Measurement issues

In common with many residue test methods, the overall precision of results (i.e. including sampling) is not well documented. Our own assessment of the 95% confidence limits based on replicated analyses is of the order of ± 30% of the mean value.

Results can be expressed as permethrin w/w% (=mg/kg x 10000), or v/w%, which is calculated based on the actual formulation used. Eulan SPN is commonly used in NZ raw wool scours and hence, for convenience, we also express the result as Eulan SPN equivalent (0.10 w/w% permethrin = 1000 mg/kg is equivalent to 1.2 v/w% SPN equivalent).