THE ENVIRONMENTALLY FRIENDLY THERMO LIGNUM PEST TREATMENT FOR APPLICATION IN COMMERCIAL, INDUSTRIAL AND DOMESTIC PREMISES AND EQUIPMENT

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Summary

Although high temperature treatments to control insect pests were being used selectively for many years, side effects such as moisture loss, shrinkage, distortion etc. were always the constraint on its wider uses. The "Thermo Lignum" method of controlled heating, whilst maintaining a constant humidity level of the materials or area will enable to control infestation by a physical method and in an environmentally friendly manner. Research has shown that pests occurring in dwellings, museums, libraries, warehouses and production areas can be controlled in all their life stages effectively and quickly. The process will not cause any deterioration of the treated materials and/or premises thus obviating the use of chemicals altogether eg. methyl bromide or phosphine.

Introduction

In building preservation hot-air method of pest control has been used infrequently for several decades to treat roof timbers, building frames etc. In the process, temperature of the materials being treated need to rise to 52-55°C and at such temperatures lipids in the nerve membranes, waxy layers of the insect cuticle and for some species of insects, certain enzymes important to the metabolism degrade irreversibly which leads to the death of insects.

However, high temperatures are always liable to cause damage to a structure and to the materials within. With an increase in temperature the relative humidity decreases. The dehydration thus caused leads to stresses, develops cracks and warping in the timber. Further undesirable side effects of the uncontrolled hot air treatment could be the lifting of floor boards, flaking-off of paint layers, cobweb-like cracking in polishes, glue becoming brittle and detached. With the development of a very sophisticated computer-controlled heating and humidification system which allows very precise control, Thermo Lignum has been able to use the principle of heat disinfestation to treat very sensitive art objects. The method is now often employed for the conservation of a wide range of fine art and antiques using air-tight chambers.

Parameters

1. The temperature

   In the treatment against infestations two temperatures are key to its success. The "core" temperature of 52°C must be reached to guarantee the control of all biological material without however putting strain on the object or material itself or even damaging it. Depending on the heat resistance of this object or matter the

temperature can be raised in incremental steps, sometimes very slowly only, sometimes quite quickly. The induction temperature can therefore vary between 56° and 90°C. The process is then reversed after maintaining the desired core temperature for about one hour. Generally a total treatment time could be between of 12-24 hours for small objects and 24-36 hours for large objects, structures and buildings. With further development it would be possible to maintain the total treatment time to a maximum of 24 hours.

2. The humidity

Apart from fine-tuning the temperature control, the regulation of the relative air humidity is the by far most important aspect of the warm air treatment method. If the air humidity is not raised during the warming-up phase the rise in the induction temperature leads to dehydration of the matter to be treated leading to physical and structural damage or possibly other undesirable changes in the material. Similarly if the air humidity is not lowered in the cooling phase of the process the object or material moisture content rises with equally undesirable consequences. The Keylworth Diagram (Fig. 1) shows the pattern of the reference curve of object or material moisture as related to temperature and is the key to the preservation of a constant moisture level.

Experimental and future developments

After initial tests with bagged cocoa beans in a chamber, it is now considered possible that stored-product commodities which are generally fumigated with methyl bromide can be treated using the Thermo Lignum system. However, more in-depth research would be necessary to establish the temperature and humidity parameters pertaining to each commodity.

With the experiences gained from the small-scale treatments, Thermo Lignum has now extended its capability to treat whole buildings but maintaining the same heat and humidity parameters (Fig. 2 & 3). To enhance efficiency of the process, buildings are usually covered with heat-sealed thick aluminium-backed polythene sheeting and sealed to the ground. There is some indication that in addition to the infestation control, fungus attack on timber (dry rot) can also be treated *in situ* by the same method. This may save expensive refurbishment of buildings.

Further research will initially concentrate on the food commodity parameters and on the development of a versatile and economical mobile system which would be suitable for treating commodities *in situ* in make-shift tents or in purpose-built commercial structures. Parallel research efforts will be directed towards treating food production premises (flour mills, bakeries) and warehouses to replace methyl bromide.

Fig. 1 Keylworth Diagram

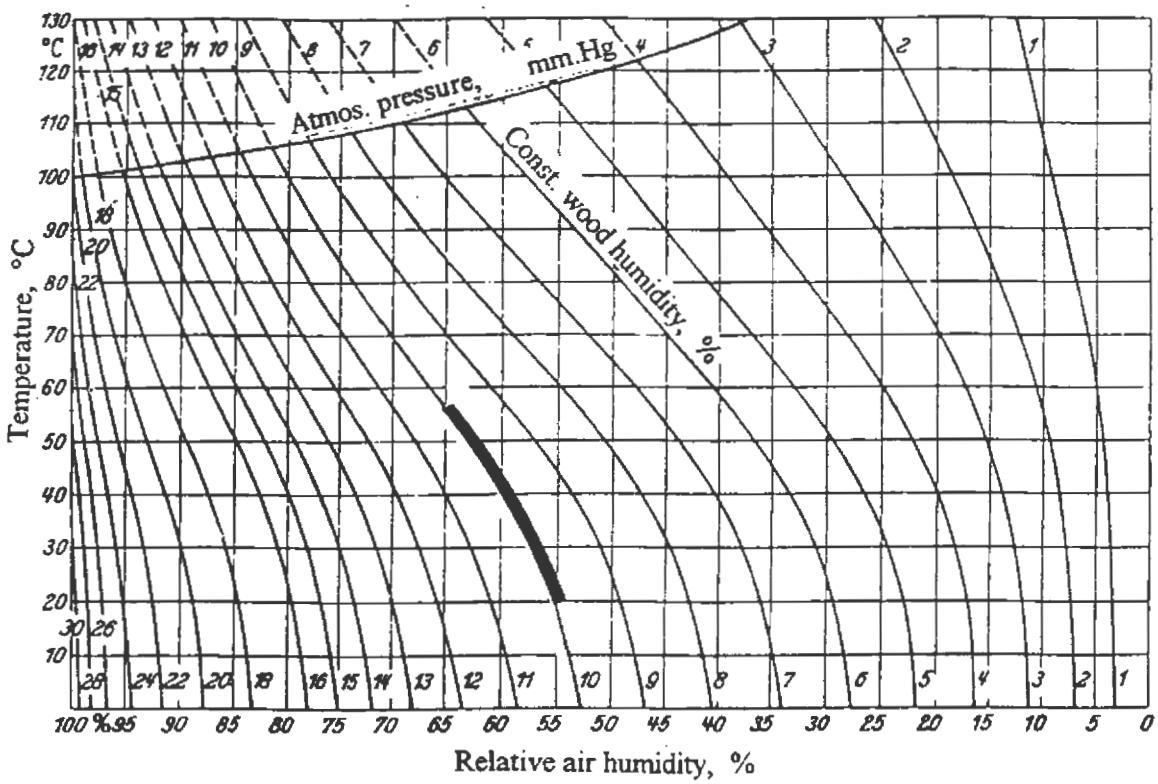
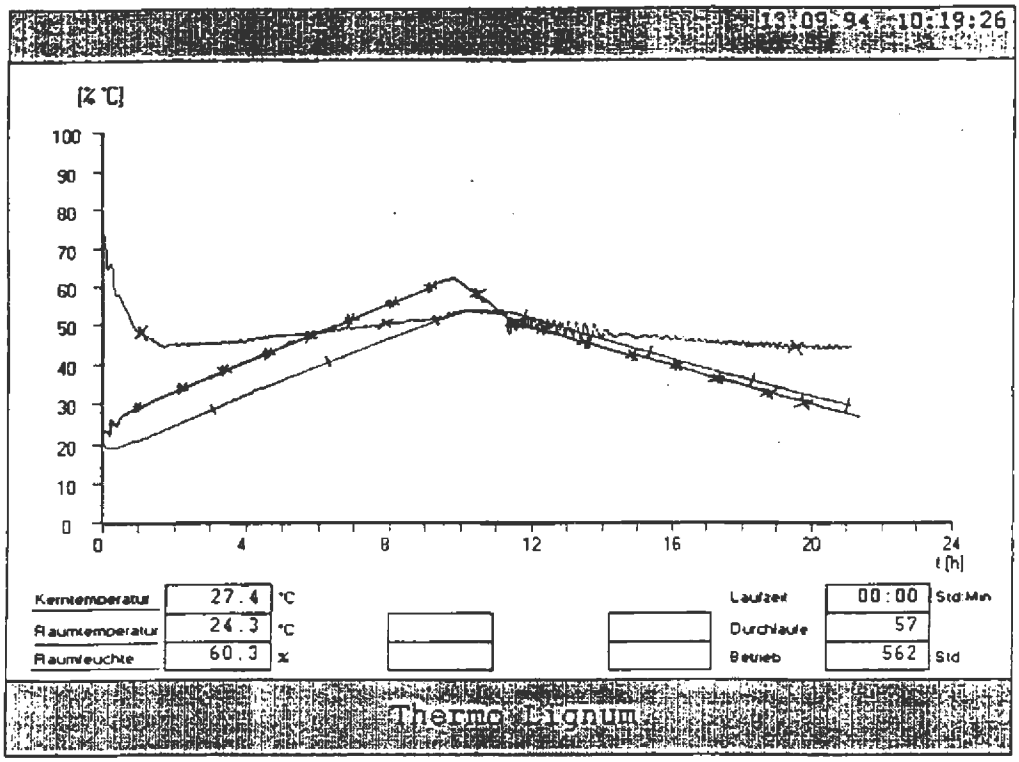
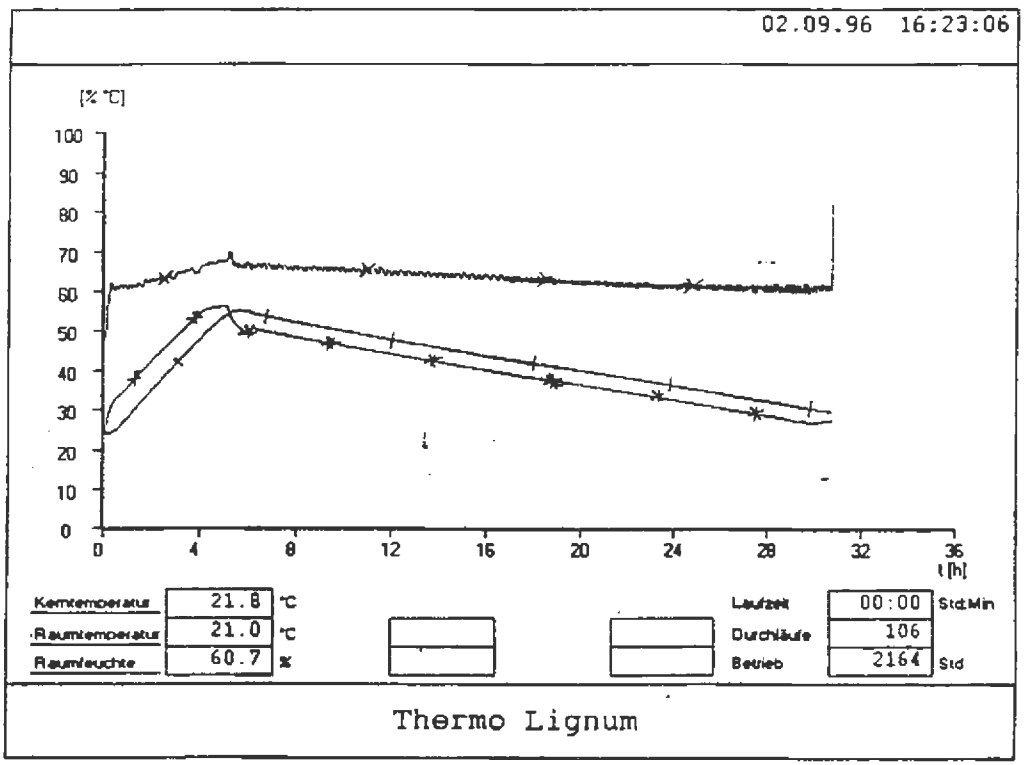


Fig.2 Computer temperature-humidity graph of typical treatment cycle



Core Temperature
Room Temperature
Room R H.

Fig.3 Computer temperature-humidity graph of typical treatment cycle



Core Temperature
Room Temperature
Room R.H.