ADOPTION OF A SUSTAINABLE GREEN TECHNOLOGY APPROACH IN SHOE SOLE PRODUCTION IN GUANAJUATO, MEXICO

Introduction

The manufacture of shoes is an important industry in Mexico—particularly in the Guanajuato region which produces each year around 244 million pairs of shoes in over 7,000 enterprises that employ 135,000 people directly (and some 270,000 indirectly). Most of these shoes are fit with microcellular polyurethane shoesoles many of which, in turn, are blown with HCFC-141b. Other than rigid insulation foams, the blowing agent requires blowing capability only—while providing good structural properties—no thermal insulation.

The Challenge

To phase out the use of HCFC-141b, existing HCFC phase-out technologies such as hexane, HFCs and water were considered along with two innovative technologies: methyl formate and methylal, both oxygenated hydrocarbons, or HCOs. In cooperation with UNDP, the Government of Mexico participated in two MLF-sponsored pilot projects to assess the use of methyl formate (MF) and methylal (ML) as HCFC replacement. The projects were executed at Zadro, a major supplier of PU systems to the Mexican shoesole industry.

The challenge was to provide the industry with zero-ODS, low-GWP non-flammable systems that would work as well as HCFC-141b. The evaluation, completed in 2011, showed that:

- HFCs do not meet the GWP requirement. They are only accepted by the Government of Mexico as an interim step;
- Hexane systems are highly flammable;
- Methyl formate (MF), while flammable in its pure form, can achieve the same level of performance on flammability criterion as HCFC-141b in PU systems. It shows, however, an incremental lower system stability compared to HCFC-141b;
- Methylal (ML), while also flammable, allows producing non-flammable systems with the same properties as HCFC-141b;
- All-water-based systems are acceptable in processing and are non-flammable. However, higher viscosity and density limit the use of water-based systems.

It was decided to proceed with industrial trials using ML and water. As the system based on these technologies performed well in the market but required the system house to cope with flammable pure methylal, explosion proofing similar to the use of hydrocarbons was needed. In addition, homogenising the PU system before use at the customer was desired. Zadro designed for this purpose a retrofit package consisting of a system blender, ventilation and a material transfer system.

These measures led to acceptable processing and products with water as well as methylal. As a result, it phased out by mid-2014 the use of HCFC-141b with non-ODS, low-GWP substances at all its customers. The customer is left with the decision to use water or methylal—and frequently uses both depending on required properties.

The Outcome and Lessons Learnt

The outcome was shared with other system houses, resulting in:

- 3 system houses offering water as well as ML systems;
- 2 system houses still considering their options;
- 15 end users converting already to ML or water, and
- 1 distributor offering ML as well as water-base systems

What was learned was that customers, being skeptical in the beginning in accepting yet another conversion, when involved all along in the decision process, are willing to proceed with sustainable conversion.

Example of a system house blending system

Example of an end-user blender

Sources:

- UNDP

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