Multilateral Fund
for the Implementation of the Montreal Protocol

OBJECTIVE

To develop, optimize and validate the safe use of methylal as blowing agent as an alternative to HCFC-141b in the manufacturing of polyurethane (PU) foam

DEMONSTRATION OF METHYLAL AS BLOWING AGENT IN THE MANUFACTURE OF POLYURETHANE FOAM

Project title	Pilot project to validate methylal as blowing agent in the manufacture of polyurethane foam
Country	Brazil
Agency	UNDP
Sector	Foam
Subsector/application	PU foam: non-insulation and insulation foam (16 applications)
Enterprise/ systems house	Arinos Quimica, Ltd
Baseline technology	HCFC-141b
Alternative technology	Methylal
GWP (alternative technology)	Negligible
Potential safety issues	Flammable pure
ODS phase-out (mt)	0
ODS phase-out (ODP tonnes)	0

DESCRIPTION

The project assessed the performance of methylal-based systems compared to HCFC-141b-based-systems in 16 PU foam applications. The assessment of methylal in PU foam applications addressed the following:

- Health, safety and environmental considerations;
- Issues concerning its processability (e.g., stability, compatibility shipping and storage);
- System composition;
- Overview of the physical properties obtained from trials for different applications;
- Indicative costs of conversion for introduction of the technology in systems houses and foam enterprises;
- Assessment of the supply scenario to ensure that methylal technology would be available worldwide.

The project was designed around Arinos systems house (Arinos Quimica Ltda), a large chemical distributor and PU systems house. Input was provided by Lambiotte & Cie/Belgium (major methylal supplier), and assistance was provided by Dow-Brazil for product testing. All development and initial optimization trials took place at Arinos. Final optimization

and validation took place at selected downstream users. Physical testing was conducted at Arinos and Dow Brazil. The development and testing of PU shoe soles was performed through Zadro in Mexico.

RESULTS

Health, safety, environment: The use of methylal does not create incremental health concerns. Flammability is an inherent safety risk, which could be mitigated drastically at the downstream-user level through the use of pre-blended systems. Methylal-based systems do not pose an environmental hazard based on current knowledge.

System processability: Safety considerations are required for shipment and storage of pure methylal, while no special considerations are required for fully formulated systems with less than 2% methylal; systems containing 2-5 php methylal need individual consideration, and above that level compliance with GHS category 2 or 3 is required; local regulations have to be consulted. Methylal-based systems for all applications are stable. Methylal and methylal blends are not corrosive. There are no compatibility issues between methylal and polyols and/or additives; however, it is recommended that the compatibility of baseline polyols be checked when planning a conversion. The shelf life of methylal meets the commercial requirement of at least 6 months under standardized conditions.

Foam properties: Methylal non-insulation foams, regardless of application, match HCFC-141b foam. Methylal-based thermal insulation foams match HCFC-141b foams within a determined variation range in stability and density but carry a penalty in insulation value of up to 10%. No data on long-term performance is yet available.

Supply scenario: Methylal is available from manufacturers in Belgium, China, India, the Republic of Korea and the United Kingdom of Great Britain and Northern Ireland. While methylal has been patented for several PU applications, none of the patents have resulted in attempts to license its use.

Summary of the results of the assessment of methylal in PU foam applications

Application	Health, safety, environment	Processability	Physical properties	Assessment
Non-insulation foam				
Flexible	+	+	+	+
Shoe soles	+	+	+	+
Structural (rigid)	+	+	+	+
Semi-flexible	+	+	+	+
Flexible moulded	+	+	+	+
Hyper-soft block	+	+	+	+
Viscoelastic molded	+	+	+	+
Viscoelastic block	+	+	+	+
Packaging foam	+	+	+	+
Insulation foams				
Refrigeration	+	+	+	+/-
Water heaters	+	+	+	+/-
Trucks	+	+	+	+/-
Blocks, Panels	+	+	+	+/-
Spray	+	+	+	+/-
Thermoware	+	+	+	+/-
Polyisocyanurate foam (PIR)	+	+	+	+/-

COST ANALYSIS

Methylal can generally be implemented without changing the equipment in the baseline. The actual costs are mainly related to electrical grounding of the foam dispenser, installation of a methylal sensor (or alternatively, regular industrial hygiene surveys by the systems suppliers), and installation of an emission exhaust system. New equipment is only needed in cases where the user conducts manual foaming. A general cost template has been developed to calculate the incremental cost of conversion from HCFC-141b to methylal-based foams. Incremental capital and operating costs can differ significantly from country to country and are also subject to economy-of-scale considerations.

CONCLUSION

Based on the assessment, the use of methylal as an alternative blowing agent to replace HCFC-141b in PU foam applications may be feasible. The results indicate that methylal is better suited for non-insulation foam than for insulation foam. Taking into consideration that the comparison is being made between optimized HCFC-141b-based systems and recently developed methylal-based systems, the results for rigid (insulation) foam applications resulted in a penalty in insulation value of up to 10 per cent. Therefore, the use and further optimization of methylal systems in those applications should be individually evaluated by enterprises. Additionally, the adoption of methylal technology would have to be subject to the following conditions:

1) Conversion of enterprises should preferably be done through systems houses;
2) Chemical compatibility has to be verified during project preparation;
3) Implications related to the substance's flammability have to be taken into consideration.

An assessment of the supply scenario concluded that methylal is commonly available and freely used.

FINAL REPORT AND SECRETARIAT'S COMMENTS

Additional details on this project are available in the link below:

http://www.multilateralfund.org/66/English/1/6617.pdf (paragraphs 106 to 119)
http://www.multilateralfund.org/66/English/1/6617p5.pdf