PMA Polyurethane Manufacturers Association

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Summary of the PMA Emission and Extraction Study

The PMA has commissioned EHS Analytics to perform emissions and extraction testing of the following potential residual compounds in hot cast/heat cured polyurethane elastomers: TDI, TDA, MDI, MDA and MOCA. TDA (toluene diamine) and MDA (methylene diphenyl diamine) are included in this study because they are the hydrolysis by products of TDI and MDI, respectively. Here is a detailed summary of the study.

For the emissions testing, EHS Analytics will be using their state-of-the-art equipment which accounts for residual emitted compounds which adsorb to the surfaces of the testing chamber and tubing. EHS has already developed methods for TDI and TDA, MDI and MDA and will develop a method for MOCA. The data from the emissions study will be in micrograms per time period so it will be directly relevant to the CA Prop 65 Safe Harbor limits for air exposure which are in micrograms/day. The testing conditions will be at ambient and 50 C (considered the highest practical temperature in real life).

For the extraction testing, EHS will be using acetonitrile as the extraction solvent. Previously PMA supplier members have provided extraction data for residual unreacted MOCA using toluene as a solvent. Acetonitrile has a lower boiling point of 82 C versus toluene which has a boiling point of 111 C. We are hoping that the lower boiling point solvent will minimize any chemical degradation which might result in the formation of additional unreacted TDI, TDA, MDI, MDA or MOCA. The results for the extraction study will be in weight % of residual unreacted compound. This data will be directly relevant to EU REACH which typically sets a level of 0.1 weight percent maximum for SVHC (substances of very concern) compounds. The data will not be directly applicable to the CA Prop 65 Safe Harbor limits for skin exposure which are in micrograms/day. In a future study, the PMA could commission an Industrial Hygienist/Toxicologist to translate the weight percent data into micrograms/day exposure, however, this would be an additional expenditure.

The following hot cast/heat cured elastomer compositions will be used for this study. The reason for choosing these particular compositions is shown in the comments below:

1) TDI, TDA
    a. 75D Conventional TDI/PTMEG/MOCA at 0.90 stoichiometry

       Comments: Worst case scenario for residual TDI or TDA given the high hardness of the elastomer (high TDI content) and the fact that the TDI on an equivalence basis would be in 10% excess given the stoichiometry of 0.90.

    b. 70D Conventional TDI/ester/MOCA at 0.90 stoichiometry

       Comments: Expands the study to polyester based elastomers

    c. 75D Conventional TDI/PPG/MOCA at 0.90 stoichiometry

       Comments: Expands the study to PPG based elastomers

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2) MDI, MDA
    a. 95A Conventional TDI/PTMEG/MDA*NaCl at the highest practical stoichiometry

       Comments: Worst case scenario for MDA*NaCl complex curative given that the stoichiometry is at the highest practical level (higher MDA content).
    b. 93A Conventional MDI/ester/1,4-BDO at 0.95 stoichiometry

       Comments: Worst case scenario for residual MDI or MDA given the stoichiometry of 0.95 which would be on the low end (highest MDI content) of the typical range (0.95 to 0.98).
    c. 85A Conventional MDI/ester/1,4-BDO at 0.95 stoichiometry

       Comments: Expands to most commonly used hardness of 85A for MDI elastomers
    d. 85A Conventional MDI/PTMEG/1,4-BDO at 0.95 stoichiometry

       Comments: Expands the study to PTMEG based elastomers.
3) MOCA
    a. 75D Low Free TDI/PTMEG/MOCA at 1.02 stoichiometry

       Comments: Worst case scenario for residual MOCA given the high hardness of the elastomer (high overall MOCA content) and the fact that the MOCA on an equivalence basis would be in 2% excess given the stoichiometry of 1.02.
    b. 75D Low Free TDI/ester/MOCA at 1.02 stoichiometry

       Comments: Expands the study to polyester based elastomers.
    c. 75D Low Free TDI/PPG/MOCA at 1.02 stoichiometry

       Comments: Expands the study to PPG based elastomers.
    d. 75D Conventional H12MDI/PTMEG/MOCA at 1.02 stoichiometry
       Comments: Expands the study to an H12MDI based elastomer.

This project will commence by the end of October 2020 and is projected to be completed about May 2021.

If you have any questions regarding this study, please contact Steve Seneker, co-chair of the PMA Advocacy Subcommittee at steve.seneker@anddev.com or via phone at 517-438-5259.