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An Investigation to Solve the Existing Problem of Undesirable Odours in Polyethylene Films

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ABSTRACT

Odor formation in polyethylene packaging films has become a serious problem in the polymer packaging industry. The characteristic odors such as musty, stale, rancid, burnt wax and sweet odors have been experienced in PE packaging films.

High temperature encountered during the manufacturing process may induce thermal decomposition products that can migrate to the surface of the film and cause undesirable odors. High shear forces encountered during the manufacturing process leads to break down of molecules and formation of odor species which cause odor problems. Use of worn off screws and barrels also enhance the effect by increasing the dwell time of the molecules due to back flow.

The main objective behind this research is to find out the odorous chemicals in the PE packaging films. GC, FT – IR and GC/MS techniques were used for chemical analysis. Initially GC was used to find the specific chemicals present in the odorous sample, but this attempt only led to a vague identification between odor sample and odor free sample. Then the FT – IR was used for the analysis. This provided details about some kind of formation of aldehyde carbonyl in odor sample. This carbonyl is also present in odor free samples but the concentration is not that significant.

GC/MS was used to further analyze the samples. In GC/MS, it is found that nonanal (C – 9 aldehyde) is present in both samples but high concentration in odor samples and low concentration in odor free samples.

The odor definition of nonanal is said to be rancid & musty as defined in odor characteristic. It has relatively low molecular weight so that the migration will be faster. The odor threshold level is also very low in nonanal and it is as low as ppb levels. Apart of nonanal, there are some other odorous chemicals such as ketones and esters present in odor samples.

It is found that the reasons for these formations are due to high heat absorption of the processed material due to worn off screws and barrels.

In this thesis this matter is broadly discussed, and root causes for the odor formation are determined. An identification test (Spot test) is developed to determine the odor in the factory floor. Finally it can be clearly seen that the formation of odors is mainly due to use of worn off screws and barrels in extruders. High temperatures, screw speeds and dwell time accompanied with them enhance the problem.

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