

## **Filled or foamed PVC pipes which solution achieves highest benefit?**

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PVC Sewer pipes for non pressure pipe applications have a market share of about 50 % of the hole pipe market. It is the most competitive market of all pipe applications. Raw material saving and high productivity with a quality according to the required standard, is the most important issue to bring up the margin. It is important because in this low margin market raw material cost is approximately 80 % of the production cost. The market developed two solutions to reduce the material cost:

filling and foaming. The question is: Which solutions gives the higher benefit in the long term production?

If we look to processing of high filled formulations usually we have to handle dry blends with more than 40 pph Calcium Carbonate. These dry blends have very bad flow characteristics. Special material transportation from the day silo to the extruder and also special material feeding systems on the extruder have to be used to prevent unstable filling of the extruder intake.

Vertical dosing of dry blend is needed with a sort of force feeding to have proper screw filling. The screw filling is a major factor for good plastification and gelation of high filled formulations. If the feed section is fully filled very good gelation and no methylen attack happen.

Another difficulty is the air escape from the dry blend. If bad calcium carbonat quality is used, the air escape can be very difficult and sometime not possible. Bad air escape leads to unstable extrusion condition with fluctuations in pressure and load.

Cincinnati developed a special screw geometry with a section after the intake to make air escape efficient at the right place. This solution is an alternative to long extruders (36D) with two venting sections. On the other hand it is well known, that high filled formulations cause wear on screw and barrel. Depending on the quality of the filler this wear can be very strong after short running time and always exists not depending on compression ratios, not depending on L/D ratios. This wear takes place in the transmission section, where the dry blend starts to agglomerate and it happens in the output sections where the melt flows. The wear has to be calculated as additional cost in the production cost analysis.

If we know how to solve the processing difficulties in case of high filled formulations

This process is able to reduce the material cost and on the other hand lower educated operators are able to run this process. The extrusion process is simple As with normal filled PVC- Formulations.

On the other hand we have foam core pipes. Today two formulations, k-value 68 for the skin & k-value 58 for the foam are mostly used. This requires two silos and higher investment cost for the material handling system. One pack is on the market which can be used for skin-layer as well as for the foam-layer. Therefore formulation development today is in the meantime not a complicated issue. It is the technology of today to add the blowing agent as micro granulate directly on the extruder and the in line mixing system takes care for a good

dispersion of dry blend and blowing agent. The requirement of the coex-tooling is highest output up to 1200 kg/h at lowest formulation cost and quick start up. Two extruders, blowing effects, adjustments to achieve lowest meter weight, processing of regrind just to mention some criteria are more complicated compared to compact pipe extrusion. Our experience is, that much more training and education of the operators are needed. The line supplier has to accompany the customer in the start up period much longer, compared to single layer extrusion. Most difficulties are due to the pipe optimisation, that means to adjust the pipe dimensions to get the highest saving and to be according to the standard.

The investment cost on a coextrusion line compared to a extrusion line for compact pipes to produce the same meter of pipes at the same time is higher. The higher investment cost are caused by additional cost for material handling, second extruder and higher cost for the coex tooling. A comparison of the formulation cost shows, that the recipe for compact pipes is lower in price compared to foam core pipes. But the factor which influences the hole process is the efficiency of the blowing. The high filled formulation reduces cost and productivity due to the high density and increases meter weight.

Under this evaluation the conclusion is, that the foam core pipe leads to a higher benefit for the producer.

The return of investment time can be very short in case of high output extrusion. Big extruders and high throuput coex toolings are more and more required. Long production runs helps the reduce the start up scrap and helps to run with maximum possible savings and benefits.