Thermal and Flow Process Optimization of a Injection Moulded Part through Mouldflow

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ABSTRACT - *CAE technology helps save time, money, and raw material, as well as cuts scrap, reduces the rejection rate, improves product quality, and gets new products to market faster, it is by no means a panacea for solving all molding problems. Rather, it should be recognized that CAE analysis is essentially a tool, designed to assist engineers instead of taking over their responsibilities or replacing them. Like many other tools, the usefulness of CAE technology depends on the proficiency of the user. The benefits mentioned above will not be realized unless the CAE tool is used properly. To be more specific, the accuracy of CAE analysis depends greatly on the input data provided by the user. In addition, the results generated by CAE analysis need to be correctly and intelligently interpreted by the user before sound judgments and rational decisions are made. Otherwise, users will simply be swamped by the vast amount of data without getting any useful information.*

Keywords: CAE (Computer aided engineering, CAE analysis, CAE tool

1. INTRODUCTION

Any molder can prove that all the conditions and effects discussed in this chapter do indeed occur during the injection molding process. While this knowledge alone can somewhat improve quality, it is only with the use of Moldflow analysis during the initial design stage with the mold designed for the optimum filling pattern, that these effects can be controlled and the full benefits obtained. Flow technology is concerned with the behavior of plastics during the mold filling process. A plastic part's properties depend on how the part is molded. Two parts having identical dimensions and made from the same material but molded under different conditions will have different stress and shrinkage levels and will behave differently in the field, meaning that they are in practice two different parts. The way the plastic flows into the mold is of paramount importance in determining the quality of the part. The process of filling the mold can be distinctly analyzed with the ability to predict pressure, temperature, and stress.

2. LITERATURE REVIEW

Taking the plastic injection mould of the air conditioning panel for example, through the flow simulation and analysis of the filling mould process for three gating system design programs, the paper gets each program's filling time, temperature, shearing rate, melting wiring and air pocket, injecting pressure and the distribution map of locking strength. Through comparing and analyzing, the paper draws the relatively good design program, and finds the shaping defect that may appear ahead of time, which improves the success rate of once-testing mould so as to realize shorten mould design cycle and reduce mould manufacturing cost

2.1 Identified Gaps in the Literature

Following point is being analyzed while reviewing results:

Detailed thermal analysis- Detailed flow analysis- Detailed- Quality prediction- Detailed- Injection Pressure- Experimental Setup/ Procedure

We used Autodesk mouldflow insights simulation for simulation & Analysis purpose.

3. Experimental Results and Discussion

3.1 Simulation Result

Gate Location Analysis: The purpose of the analysis is to explore the most suitable gate location for the product design and to see the alternatives from best to fair until the worst location for the gate in relation of the flow resistance during the moulding cycle

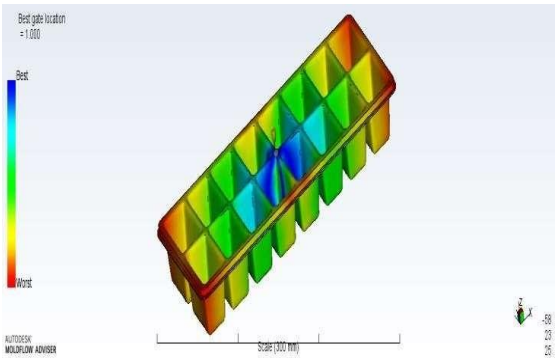

Fig. 1. Best gate location

3.2 Fill Time Analysis result

The Fill Analysis is an important start of the analysis sequence in the Mold flow soft-ware. This analysis provides the behavior of the thermoplastic material in the mould cavity during the filling phase. This analysis will calculate the flow front from the injection location; here for an injection(s) location needs to be selected before running this analysis.

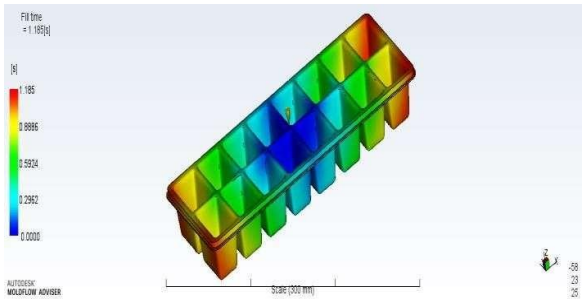

Fig.2. Fill Time Analysis result

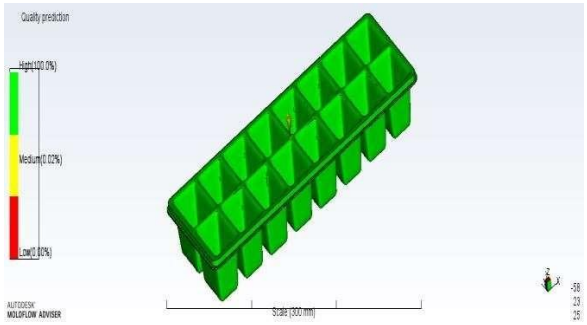

Fig.3. Confidence of fill analysis result

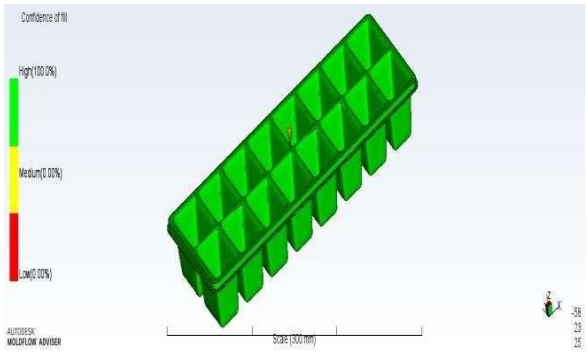

Fig.4. Quality prediction analysis result

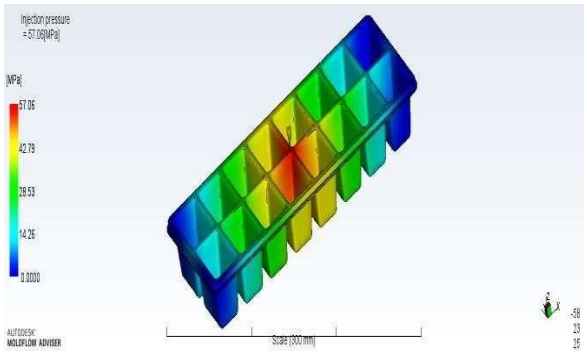

Fig.5. Injection Pressure result

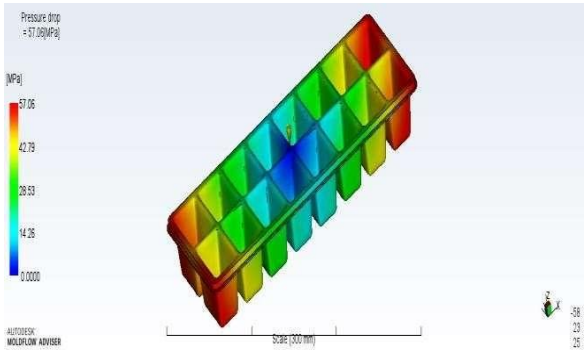

Fig.6. Pressure Drop Result

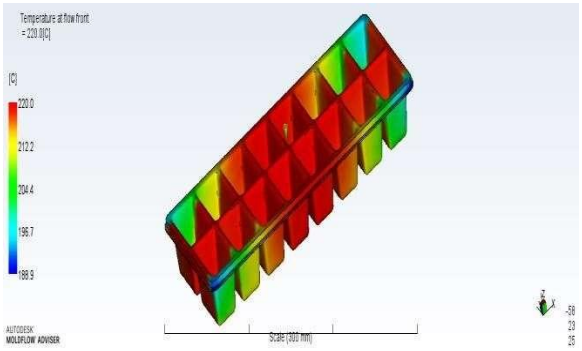

Fig.7. Temperature at flow front result

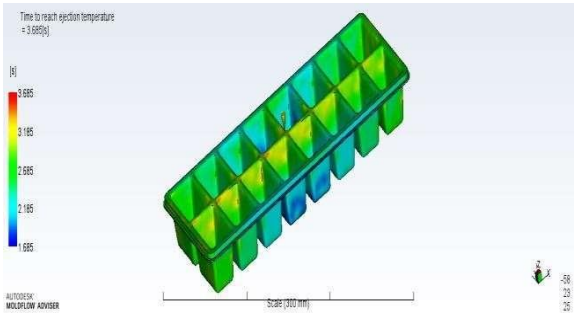

Fig.8. Time to reach ejection

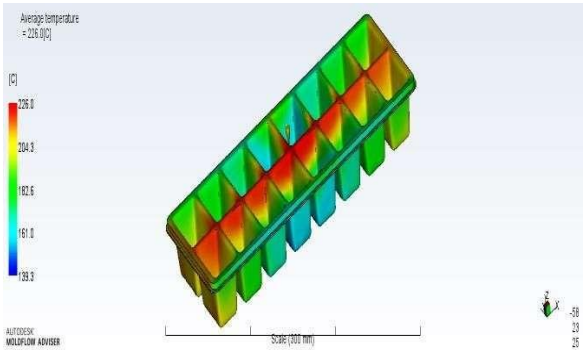

Fig.9 Average temperature

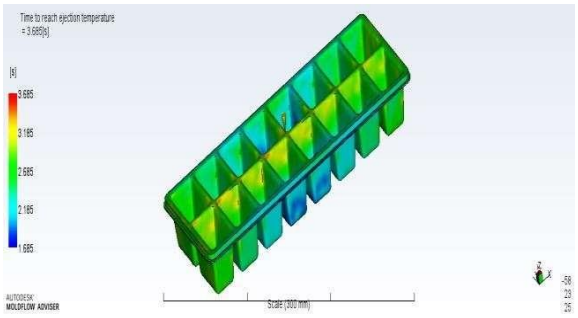

Fig.10. Frozen layer fraction at end of fill

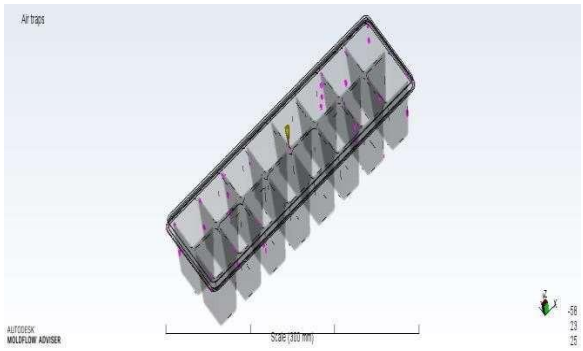

Fig.11. Air traps

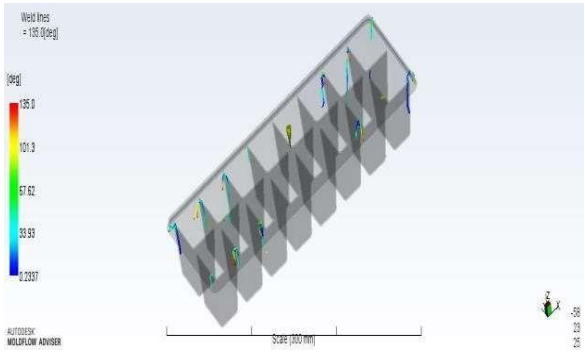

Fig.11. Weld lines

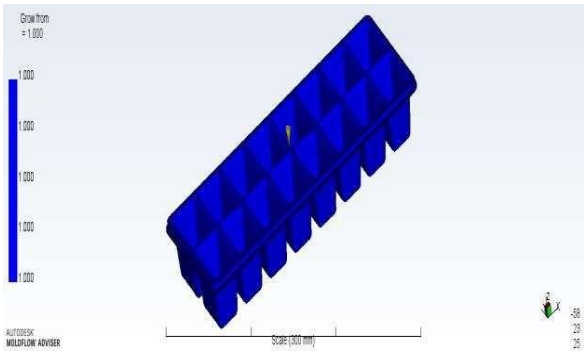

Fig.12. Grow from

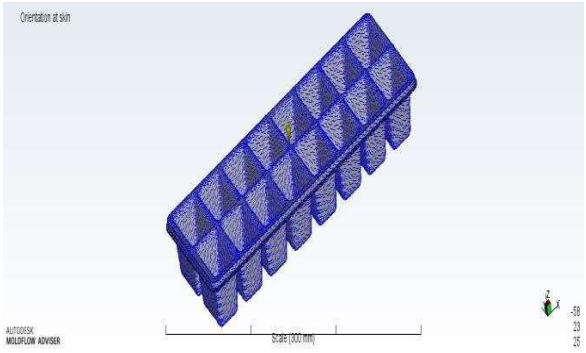

Fig.13. Orientation at skin

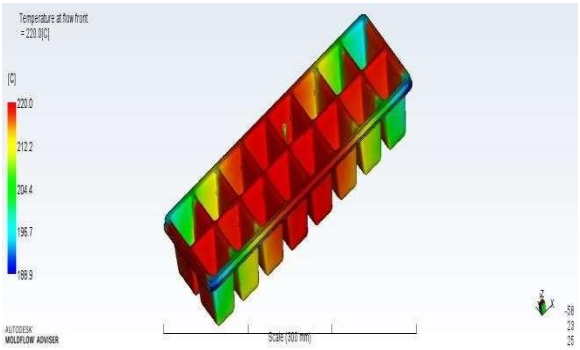

Fig.13. Plastic fill

4. CONCLUSION

We found optimized results after using mold flow, at very initial stage processing parameters & their corresponding part quality & defect is being analyzed. Product & mold designer can make necessary changes as par result obtained, one gate location & their positioning is best for this product & minimized defects.

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