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Myths and Realities of Purging for Extruders and Blow Molders

(but Injection Molders might be interested, too)

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Myths persist in the plastics processing community (especially in the extrusion and blow molding sectors) regarding the usefulness and effectiveness of purging compounds.

As with most myths, there probably was a grain of truth to support them at one time. But while industries, products and people progress and evolve myths stay frozen in time.

We will take a hard look at several of the most damaging and pervasive of these myths and discuss the realities that underlie them:

- **Purging compounds are all alike.**
- **Purging compounds just don't work.**
- **Purging compounds are too expensive.**
- **Purging compounds are hard-to-use/time consuming.**



Myth #1: Purging Compounds are all alike –

(so just get the stuff with the lowest cost per pound).

It is far from true that Purging Compounds are all alike; they are available in very distinct categories, each with its unique characteristics and each with its role to play.

Mechanical Purging Compounds and Chemical Purging Compounds

(Full disclosure: NOVACHEM supplies both types, so we can discuss the comparative advantages of each in an unbiased way – we have no particular axe to grind regarding the choice between types.)

If Purging Compounds are not all alike, how are you supposed to decide which type is best for your purging situations?

It depends on how challenging your purging situation is.



First classify the purging issue to be addressed: is it a challenging purge or is it one that is routine?

Challenging purges present one or more of the following factors:

- **Takes hours (sometimes a full shift) to accomplish; may require tearing down and manual cleaning.**
- **Involves large or complex equipment (such as large or twin-screw extrusion systems, extrusion systems with large or complex dies, blow molding systems, or injection molding systems with complex hot-runner tools).**
- **Involves exotic or advanced engineering-grade production materials (like PEEK, PEI, polysulfone, fluorocarbons, etc.).**
- **Deals with heavy degradation or contamination, a particularly stubborn color, or a wide disparity of melt viscosity.**



More routine purges are characterized by these factors:

Can usually be accomplished in a fairly short period of time; rarely requires teardown of the system.

Single screw extrusion systems of small to moderate size, feeding simple dies, or conventional injection molding systems of small to moderate tonnage with either conventional tools or, at most, very simple hot-runner tools.

Commodity materials

(i.e., PE, PS, PP or PVC) or at most, first generation engineering-grade materials (e.g., Nylon, ABS, polyester, acetals and even PC).

Limited or incipient contamination, or a color/material changeover known to be comparatively benign.

Obviously there will be no bright lines distinguishing the challenging purges from the routine ones; but experience and judgment should dictate into which category each situation will fall.

If on balance, the purging task is quite challenging then it calls for a high-performance purging compound.

If the purge is relatively routine then a commodity-grade purging material is the right choice.



Purging compounds operate on either chemical or mechanical principals.

Chemical purging compounds use reactions during the purge that have an effect on resin residues at the molecular level.

Mechanical purging compounds exploit differences in melt viscosity, or other flow characteristics, to displace resin residues from the equipment being purged.

Chemical purging compounds are very effective in dealing with challenging purges. As a group, however, they are likely to involve more process complexity than mechanical purging compounds and are likely to be somewhat more expensive on a “per pound” basis.

When considering the cost of purging products be sure to compare cost per purge as opposed to cost per pound. Chemical purging compounds are efficient (i.e., they get the job done using comparatively little material) and therefore can provide excellent value.

Mechanical purging compounds are less effective as a group and thus, will not be appropriate for the most challenging purging situations. But they can provide excellent service and value in more routine purge situations, and they offer the added benefit of being simple to use.



In choosing a purging product for any particular situation bear in mind that “one size does not fit all”.

For challenging purges your best choice will probably be a chemical purging compound.

Whichever chemical purging compound you select, be sure that your operators understand the importance of following the manufacturer’s instructions.

For routine purges, a mechanical purging compound will usually be fully satisfactory.

Even within the group of mechanical purging compounds there is a substantial variation in performance. You will need to evaluate products until you can settle on one that addresses all of your “routine” purging situations effectively.



Myth #2: Purging Compounds just don't work* –

(so you may as well tear down the equipment or run resin or regrind until the problem goes away).

**Sometimes this myth is expressed as: "Resin (or regrind) is just as good as any purging compound."*

There are many people in our industry who have had an unsatisfactory experience with a purging compound... and it has left them with the impression that purging compounds "don't work." (This is usually associated with the ability of the products to address contamination issues – i.e., to "remove carbon.")

Two reasons account for most of the "bad experiences":

The purging compound supplier encouraged unrealistic expectations for his product's performance (to make a sale?);

The purging compound was being asked to do something for which it was not suited (because neither the supplier nor the user truly understood the nature of the problem).

Most responsible suppliers, now older and wiser, understand that purging compounds DO work – if you ask them to do what they are designed to do – to control carbon (and other forms of contamination).



Contamination Control vs. Contamination Removal

The appearance of contamination in the product is evidence of a significant amount of degraded material inside the equipment.

The tendency to continue production so long as contamination levels can be tolerated gives the problem time to grow severe.

NO purging compound will remove all contamination from a severely compromised system.

The proper role of a purging compound is to be an essential part of a program designed to prevent the buildup of carbon (and minimize the impact of gels).



First, understand the source(s) of any degradation issues.

Almost always, fairly small amounts of material accumulating excessive heat history – but how? Why?

Then, apply corrective measures – purging compounds, properly used – at the appropriate times.

Usually at shutdown, or at the very first evidence that degradation is occurring.

It is pointless (and sometimes counter-productive) to introduce a purging compound into a situation where contamination is already severe – just let the guys with the wrenches do their job!

A detailed discussion is beyond the scope of today's presentation. We recommend that you download and read our paper, Toward a Systematic Approach to Evaluation and Resolution of Purging Issues in Thermoplastics Processing from our web site at <http://www.novachem.net/techpapers.htm>



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Purging compounds DO WORK – when used correctly, as an essential tool for keeping your systems out of trouble.

You perform preventive maintenance by changing hydraulic system filters, adding anti-scale compounds to cooling systems, and in other areas.

In the same way, you should regard purging for control of degradation as a normal P/M item that will avert costly and time-consuming problems down the road.



Myth #3: Purging Compounds are too expensive for regular use –

(but maybe we'll keep a bag or two in the shop for “emergencies”)*.

**This attitude, treating purging compound as a fire-extinguisher instead of as a regular planned-maintenance tool, feeds back into the myth that “purging compounds don't work” by setting them up for failure!*

This myth probably had its start years ago when it was normal for the cost of a pound of purging compound to be much greater than the cost of a typical pound of resin. A lot has changed over the years...

The economic consequences of unplanned or extended downtime have become severe in today's hyper-competitive manufacturing environment.

The cost of resin has skyrocketed, for almost every resin type.

And of course, the cost of a pound of purging compound really has never mattered.

The cost-per-purge (compared with alternative ways of dealing with the problem) is the only thing that counts.



To see past the myth, you have to understand the true costs of purging issues, including:

Direct Costs (labor and materials needed for changeovers or cleanup).

Indirect Costs (the contribution of a machine to all of the costs of the business; the machine rate).

Opportunity Costs (the profit that the business is not making while the machine is not running and the profit not made while the system is running but making scrap!).



Once the costs of each occurrence of a purging issue are well understood it's straightforward to determine the savings that would accrue through the proper use of a purging compound.

These savings normally come from:

- Reduced labor and material losses as teardowns become infrequent;

- Less downtime as changeovers are made more quickly and unscheduled shutdowns are avoided;

- More profit as the amount of product produced by each processing system is increased.

In short, we feel that purging compounds are not too expensive – in fact, they are a bargain!

These issues are addressed in detail in a document titled The Economic Case for Purging Compounds in Plastics Processing that can be downloaded from our internet site at http://www.novachem.net/files/NOV_SME_2007.pdf



Myth #4: Purging Compounds are hard-to-use/time consuming.

This myth most often focuses on the perceived complexity of using chemical purging compounds.

The reluctance to use chemical purging compounds when they are appropriate (i.e., in challenging purges) has two results...

The user tries to address the need with a mechanical purging compound that is not up to the task, and gets disappointing results...

The myth that “purging compounds don’t work” gets reinforced.

It’s true... the procedures for use of chemical purging compounds are a bit more involved and a bit more critical than those for mechanical purging compounds.

The bottom line is that you have to use the right tool for the job; when you need the effectiveness of a chemical purging compound, the extra effort pays real dividends. The purging compound manufacturer will provide the support necessary to attain the best possible result.

Complex problems often require complex solutions!



Summary.

Myth #1: Purging compounds are all alike.

Fact: Purging compounds differ, and one size does not fit all; so choose the right one for your situation and it will serve you well.

Myth #2: Purging compounds just don't work.

Fact: Purging compounds, like any other tool, work well when used correctly for the job intended.

Myth #3: Purging compounds are too expensive.

Fact: Purging compounds are a bargain when used to enhance productivity and avoid costly downtime and unplanned teardowns.

Myth #4: Purging compounds are hard-to-use/time-consuming

Fact: Some procedures are more demanding than others; but the results will justify the invested effort.

Based on these facts, we hope you'll scrap everything that you thought you know about purging and adopt a changed view of this product class.