



The Economic Case for Purging Compounds in Plastics Processing

Presented by Frank Van Haste



At NOVACHEM, our experience with purging issues stretches back over 25 years. Over this time our industry has changed remarkably.

25 years ago the usual approach to purging issues was episodic, situational and impulsive.

Today, the pressures that demand peak productivity require approaches to all aspects of production that are systematic, procedural and rigorous.

Purging Issues are not exempt from these pressures and these requirements.



In today's globalized manufacturing world, no manager with P&L responsibility would implement a production process without full understanding of costs and sound economic justification.

The response to purging issues is an integral part of the production process and deserves the same level of understanding and the same economic justification as every other aspect.

We can offer experience-based tools to analyze the economic case for purging alternatives and to resolve lingering negative attitudes that result from past unsatisfactory experiences.



To evaluate the suitability of Purging Compounds in a new situation we seek answers to four simple questions:

- What is happening?
- When does it happen?
- What is done about it now?
- What are the associated costs?

The first three questions allow us to characterize the need technically and to arrive at recommendations for products and procedures.

The fourth question allows us to determine the value of our recommendations and to make a convincing economic case for purging compounds. **This is necessary to fully integrate purging issues and methods into the production process environment.**



It is critical to arrive at a full understanding of the costs associated with purging issues, both for present practices and for proposed changes or improvements. (You would do no less for any other aspect of production!)

This is true for all types of purging issues:

- Dark-to-light color changes
- High viscosity to low viscosity material changes
- Control of degradation or contamination



Toward a Systematic Approach to Evaluation and Resolution of Purging Issues in Thermoplastics Processing

Frank Van Haste
General Manager
NOVACHEM

The NOVACHEM logo is located at the bottom right of the document cover image, rendered in white text on a dark grey background.

We find a simple Cost Comparison Sheet we've created very useful in recording the costs associated with purging issues and then thinking about them.

The sheet is available as part of a free technical paper entitled Toward a Systematic Approach to Evaluation and Resolution of Purging Issues in Thermoplastics Processing. It can be downloaded from our Internet web site at: <http://www.novachem.net/techpapers.htm>

(We hope you'll read the rest of the paper, as well!)



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Purging Methods Cost Comparison Sheet

	Method #1	Method #2	Method #3
Machine Time Lost	Hours	Hours	Hours
Machine Rate	\$ /Hour	\$ /Hour	\$ /Hour
Cost of Lost Machine Time			
(Time X Rate)	\$	\$	\$
Teardown Labor	Workers	Workers	Workers
Teardown Time	Hours	Hours	Hours
Teardown Labor Rate	\$/Hour	\$/Hour	\$/Hour
Teardown Labor Cost			
(Workers X Time X Rate)	\$	\$	\$
Material Usage			
Resin Consumed	Lbs.	Lbs.	Lbs.
Resin Price	\$ /lb.	\$ /lb.	\$ /lb.
Credit for Salvage/Regrind Value	-\$ /lb.	-\$ /lb.	-\$ /lb.
Net Unit Cost of Resin	\$ /lb.	\$ /lb.	\$ /lb.
Total Cost of Resin Consumed			
(Lbs. X Net Cost/lb.)	\$	\$	\$
Purge Compound Consumed	Lbs.	Lbs.	Lbs.
Purge Compound Price	\$ /lb.	\$ /lb.	\$ /lb.
Total Cost of Purge Compound			
(Lbs. X Net Cost/lb.)	\$	\$	\$
Purging Labor	Workers	Workers	Workers
Purging Time	Hours	Hours	Hours
Purging Labor Rate	\$/Hour	\$/Hour	\$/Hour
Purging Labor Cost			
(Workers X Time X Rate)	\$	\$	\$
Lost Production Profit	\$	\$	\$
Miscellaneous Costs	\$	\$	\$
Total Cost per Event	\$	\$	\$



To understand fully the costs associated with a purging issue it's helpful to break down the cost structure into simpler elements.

We look at three kinds of costs:

- Indirect costs
- Direct costs
- Opportunity costs



Indirect Costs

The indirect costs associated with resolution of a purging issue are equal to the *hours of machine time lost* multiplied by the *core machine rate*.

The *machine time lost* is simply the time elapsed from manufacture of the last good part before production was stopped until the first good part is produced after the machine is re-started.

The *core machine rate* typically consists of the following elements:

- Depreciation or lease charge
- Interest
- Building Occupancy charge
- Maintenance allowance
- Production Utilities (power and water)
- Production Labor (average hourly rate plus burden)

It may also include costs associated with special equipment such as robots or pickers, temperature control equipment, packaging equipment etc., that may be unavoidably idled while the press is down.

The total of these items may be thought of as the contribution to the overhead of the business that the machine makes when it is operating in production.



Machine Rate Issues

An examination of machine rate survey data (here, for example: <http://www.ptonline.com/pricing/hrates.html>) discloses a broad range of reported rates for essentially similar equipment. This is attributable to differing approaches to choice of elements to include in the machine rate, and to differing abilities of organizations to capture and allocate cost data.

This variability can be a problem when trying to generalize about the economics of purging issues.

If the case for new purging practices involves investing in materials in order to save machine down-time, and if the machine rate is artificially low, the evaluation results can be misleading. This can occur if maintenance overheads are allocated equally for all press sizes – a common practice that usually understates the costs of operating large presses.

Other machine time related issues are usefully discussed here: <http://www.immnet.com/articles?article=1160>

Our conclusion is that machine rate is a useful tool for analyzing the economic impact of purging issues but that in close cases the structure of the machine rate may need a “reality check”.



Direct Costs

The direct costs associated with purging issues include:

- Teardown Labor (if applicable)
- Purging Labor (if applicable)
- Material Costs

Labor costs will typically be either those associated with purging or those associated with tear-down and mechanical cleaning of the equipment. In either case the result is the product of number of man-hours expended times the burdened labor rate.



The Material Costs associated with purging issues can include resin costs, purging compound costs, or some of each.

In the case of resin costs one needs to multiply the pounds consumed times the net cost per pound, which is the resin purchase price less a credit for regrind or salvage value.

(If the resin is completely usable as regrind in future production, the credit will almost equal the resin price. If the material is must be sent to the landfill, the credit will be zero.)

If purging compound is used, the cost is obviously the price per pound multiplied by the number of pounds used.



It is very important to note well the following:

The cost per pound of materials used in dealing with purging issues is not important! It is **ONLY the cost per purge that matters.**

In evaluating the economic impact of any proposed or current method for dealing with purging issues, you must look at both unit cost and consumption – considering only unit cost will usually be misleading.



Opportunity Cost

The most significant cost of downtime associated with purging issues can sometimes be the opportunity cost of profit foregone from salable product not made.

To estimate this, look at:

- Revenue realized per unit of production (modified to account for normal reject rates.)
- Multiplied by the units that would normally be produced over the course of the lost hours of production.
- Less the cost of material and the core machine rate.

If the items produced are work-in-process (as opposed to salable product) you may be able to estimate a “revenue” number based on value-added methods. Consult your plant accountant.



Annualization

The annual impact of purging issues on a processing facility's P&L status can be developed by:

- implementing the analysis just described for each common purging issue,
- reviewing production records to learn the frequency of occurrence of each issue,
- and then aggregating the resulting costs.

The value of proposed alternative methods can be understood by:

- making a *pro-forma* projection of the costs that the proposed alternative would impose
- and then comparing these with the costs of current methods.

In our experience, these analyses will usually make clear the economic benefits that come with the adoption of a well-designed purging program.



An Example

An injection molding operator was performing a material transition from black 30% GF Nylon to a yellow ABS once each week on a moderately large molding machine (275 ton, with a 32 oz. Barrel). He had found it necessary to partially disassemble the machine in order to remove all of the Nylon from the screw and nozzle. This extended his mold-change time from one hour to three and one-half hours.

He gathered the following data:

Core machine rate:	\$53.00/hour
Teardown Labor:	4.0 man-hours at \$32/hour (burdened)
Material Cost:	Nil
Opportunity Cost:	\$14.40/hr (180 parts/hr, valued at \$0.93 each less \$0.85 cost of inputs)

The total cost of this event is about \$296.70.



The use of a good quality mechanical purging compound is proposed and trials are performed. The use of about 2 barrel volumes of purging compound proves effective in removing all of the Nylon from the barrel. The purge can be accomplished within the one hour needed for the mold change.

Costs now include:

Material Cost: 4 lbs. at \$3.05/lb.

Purging labor: 0.5 man-hours at \$32/hour

Because the mold-change is the critical path event, no lost time or production opportunity cost is charged to the purge.

The total cost of the alternative method is about \$28.20, a saving of \$268.50 every week.

If this occurs 50 times/year, annual savings will be about \$13,400.



Conclusions

- Appropriate responses to purging issues are an integral and legitimate aspect of production processes.
- The effort needed to develop an economic justification for purging alternatives will provide confidence that the most productive procedures are in place and will dissipate any lingering negativity derived from unsatisfactory results in the past.
- NOVACHEM will be happy to discuss any specific situations.