Mitigating & Troubleshooting Pelletizing

How to resolve the most common issues in Underwater Pelletizing

With today's increasing use of complex or novel material formulations and the steady tightening of efficiency goals, it becomes ever more challenging to achieve high-quality pellets. The trend is a major driver in our industry's evolution from strand to underwater pelletizing (UWP). This transition, however, can be daunting. Initially, UWP equipment can be intimidating, and uninformed decisions can lead to costly quality issues and equipment damage. Preventing some of these troubles and dealing with those that do arise requires a combination of partnering with your UWP supplier and being aware of troubleshooting guidelines for common problems.

Troubleshooting

Step 1 - Preparation (Partnership)

Relationships with your suppliers are always important, but in the case of UWPs, the relationship is critical. Compared with strand pelletizers, the UWP is more elaborate and more sophisticated. There is a steeper learning curve, and knowledge is key. The leading pelletizer suppliers have very different philosophies on how the technology should be translated and made actionable on the shop floor. Therefore: Know your pelletizer supplier, and make sure the supplier knows you.

Make sure your supplier plays their part. It should be an UWP supplier's goal to proactively navigate quality issues and bridge that knowledge gap by partnering with processors to provide actionable and reliable guidance. A partnered UWP supplier will also keep you up to date on new technologies advantageous to your operation. This customer / supplier relationship may seem a strange place to start discussions of underwater pelletizing troubleshooting, but it has a huge impact on technical knowledge management and our qualification to complete rudimentary to mid-level UWP troubleshooting.

Step 2 - Balancing Application Spedifications with Equipment Scoope and Cost

Balance is a key attribute of any well designed and efficient process and pelletizing is no exception. In order to maximize line performance and quality, we need to pay particular attention to the performance specification.

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UWPs are the most versatile form of thermoplastic pelletizer, but too often they are treated as a general purpose tool. Many shops do so with fair success, but they often sacrifice throughput, pellet quality and efficiency. Balanced partnering between customer and UWP supplier is necessary to identify and align critical products, formulations, and throughput with the appropriate equipment and options, while minimizing cost impact to the customer. In short, the supplier should not oversell and the customer should realize that quality starts with an appropriately designed process. This part of the process falls apart when the technical specification is larger than the budget. A solid relationship with your UWP supplier can help you with early budgetary quotes, allowing the chance to better manage expectations and build realistic and predictive financial models.

Die design is one of the most critical aspects of the process and it is important to have the die correctly tuned to your materials. Key factors are:

- Die pressure
- Throughput rate
- Viscosity
- Pellet specification (g/100 pellets)

Step 3 - Commissioning and Performance Optimization

"A good start is half the job". It all comes together in implementation / startup. Now you are most likely dealing with a Field Service Engineer (FSE), who is a critical component in pellet quality and line performance. The FSE makes sure the line is installed and functioning correctly. They are also the person that initially trains your staff on the UWP and supporting auxiliary equipment. For the training to be effective they will;

- Thoroughly explain the function and do training on the mechanical aspects of the UWP
- Run and establish processes for your core products / formulations (80/20 rule)
- Review the spare parts list for the system and recommend the critical parts that need to be kept on site
- Train the maintenance staff on proper maintenance to ensure the equipment runs efficiently

A good UWP supplier will also schedule follow-up visits to evaluate the effectiveness of the training and product quality. Keep in mind that the overall optimization process and training could take several visits, but this process is necessary to minimize issues and troubleshooting in the future. Despite the best planning, equipment and execution, there will always be quality and process issues. The goal to this point has been to minimize these issues.

Step 4 - Shop Floor (Common Problems and Solutions)

If the process has been well defined by the customer and UWP supplier, defects will be minimal and relatively easy to troubleshoot. The most common defects and likely solutions are outlined below.

Irregular pellet shapes: This is the most common quality issue in pelletizing. UWP pellets should have a spherical shape. Often customers experience inconsistent-sized or flat or football-shaped pellets. These problems can be caused by feed issues, obstructions blocking the die hole, or material solidifying or freezing in the die plate.

To solve this issue, make sure there is no surging from the feeders into the extruder and that it is feeding at the correct rate. A common problem on recycling applications is that impurities are not properly filtered from the melt. This can lead to holes being blocked, so the melt filtration may need to be checked and new screens installed. Die freeze can be addressed in several ways. Make sure all of the die heaters are working and are able to maintain the proper temperature set-point.

An open-hole calculation can be used to check the number of holes actually open based on parameters such as cutter speed, number of blades on the cutter hub, the number of unplugged holes in the die plate, the throughput rate, and the pellet weight. The calculation is below:

The number of open holes = (16.67 x production rate (kg/hr)) / (weight per pellet (g) x number of cutter blades x number of unplugged holes in the die plate)

Plugging holes in a die plate is a common way to optimize the equipment based on the current production conditions. Knowing the ideal rate per hole will also help in setting up the line to run different rates of that formulation.

It is also important to check the melt temperature of the polymer and the temperature of the process water. If either of these temperatures are too low, the polymer is more likely to solidify in the die plate.

Tails & Fines: Tails are small pieces of plastic that can be formed when the pellet is not cut cleanly. As the pellets flow into the dryer, this piece of plastic can break off and get into the process water. When separated from the pellet, tails become fines.

Filtration of the process water is important to make sure there are no process disruptions, but ideally, tails and fines should not be generated. This is done by making sure the die face is in good condition. It may require having the die face ground to remove any grooves in the die plate.

For BKG® AH and AH D pelletizers, using the die grinding tool can help remove any grooves in the die. Maintaining the blades will also help to eliminate tails on the pellets. Most pelletizer manufacturers have self-sharpening blades and this can be done while the pelletizer is in operation.

Agglomerates: Agglomerates are large chunks of plastics that are commonly formed at startup of the pelletizer, but could also be formed due to an upset condition of the system.

These large pieces can damage the internal parts of the centrifugal dryer. When starting an underwater pelletizer, it is important to have material coming out of the die plate, water coming across the die face, and the pelletizer starting in a closely timed sequence. If material arrives before the pelletizer starts, agglomerates can form.

Pelletizer suppliers know how critical these start-up parameters are and have controls in place to avoid the formation of agglomerates. The FSE will properly adjust the control system during commissioning.

Doubles / Chaining: When pellets don't adequately cool, they can stick to each other. If several pellets stick together at once, this phenomenon is known as chaining. To address this issue, it is important to make sure the process water is at the correct temperature. If the water is too hot, it will not properly cool the pellets as they are cut. Another parameter to check is the melt temperature of the polymer. This has the same effect as the process water being too hot and the pellet cannot properly cool. Making sure there is sufficient process water flow can also help to address chaining. Some polymers can lubricate the face of the die plate which can contribute to chaining. It may be necessary to increase the pressure of the blades against the die plate, increase the frequency of the blade grinds, or both to address the issue.

Your relationship with your UWP supplier is the real key to success in mitigating and troubleshooting performance and pellet quality issues. They are expert guides through tough technical waters.

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