

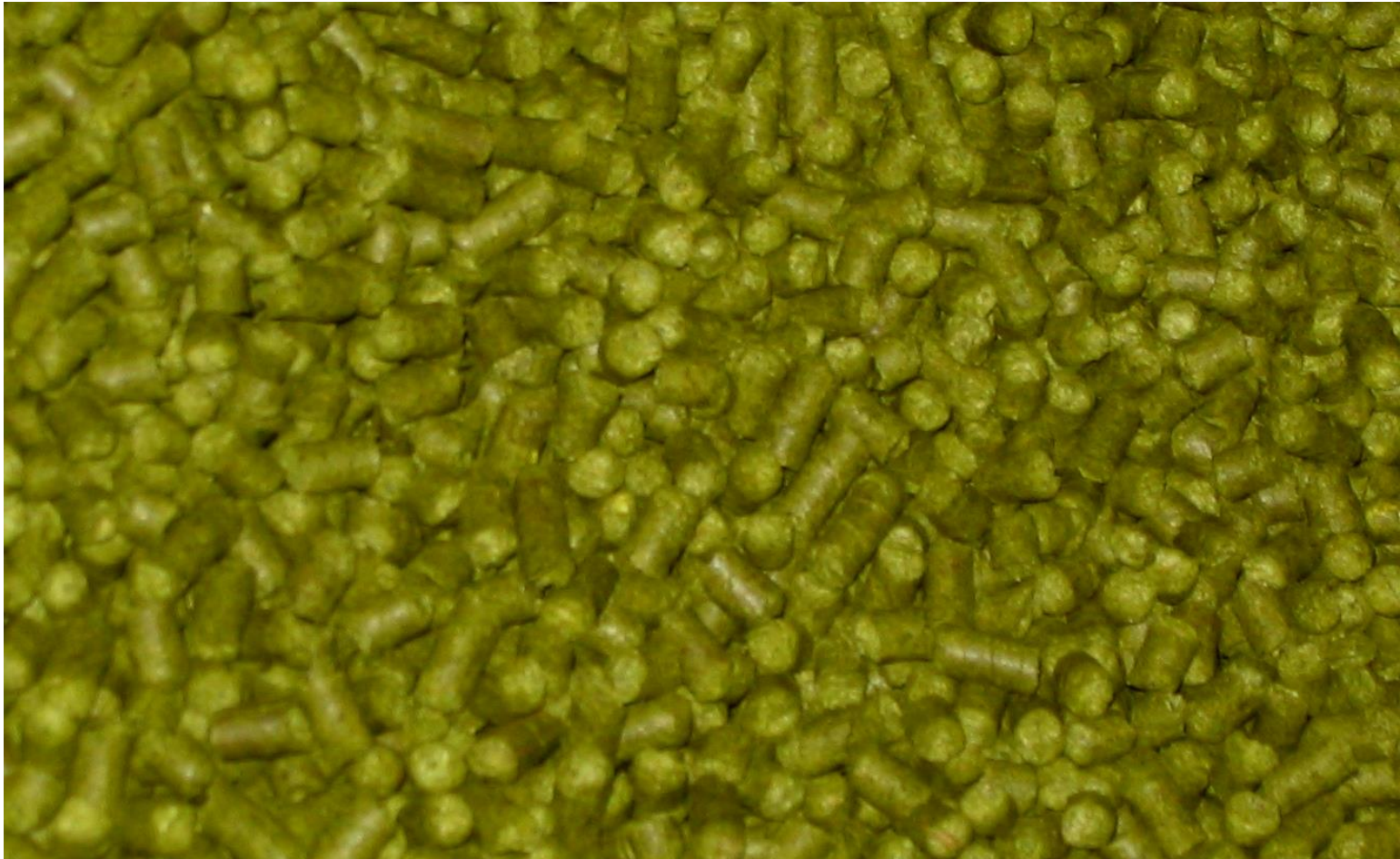
Great Lakes Malt & Hops Conference

Hop Pellets

Val Peacock

Hop Quality Group

Type 90 Pellets



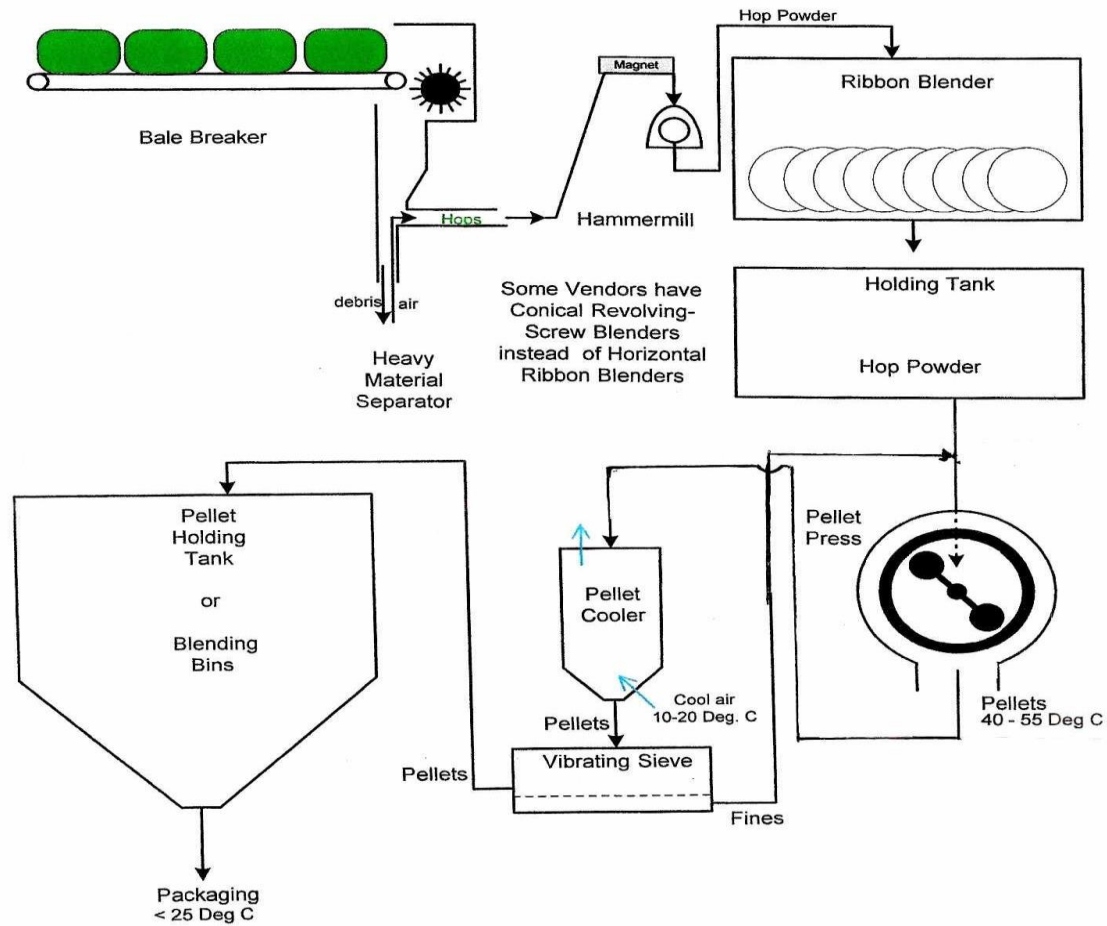
Objectives when making Hop Pellets

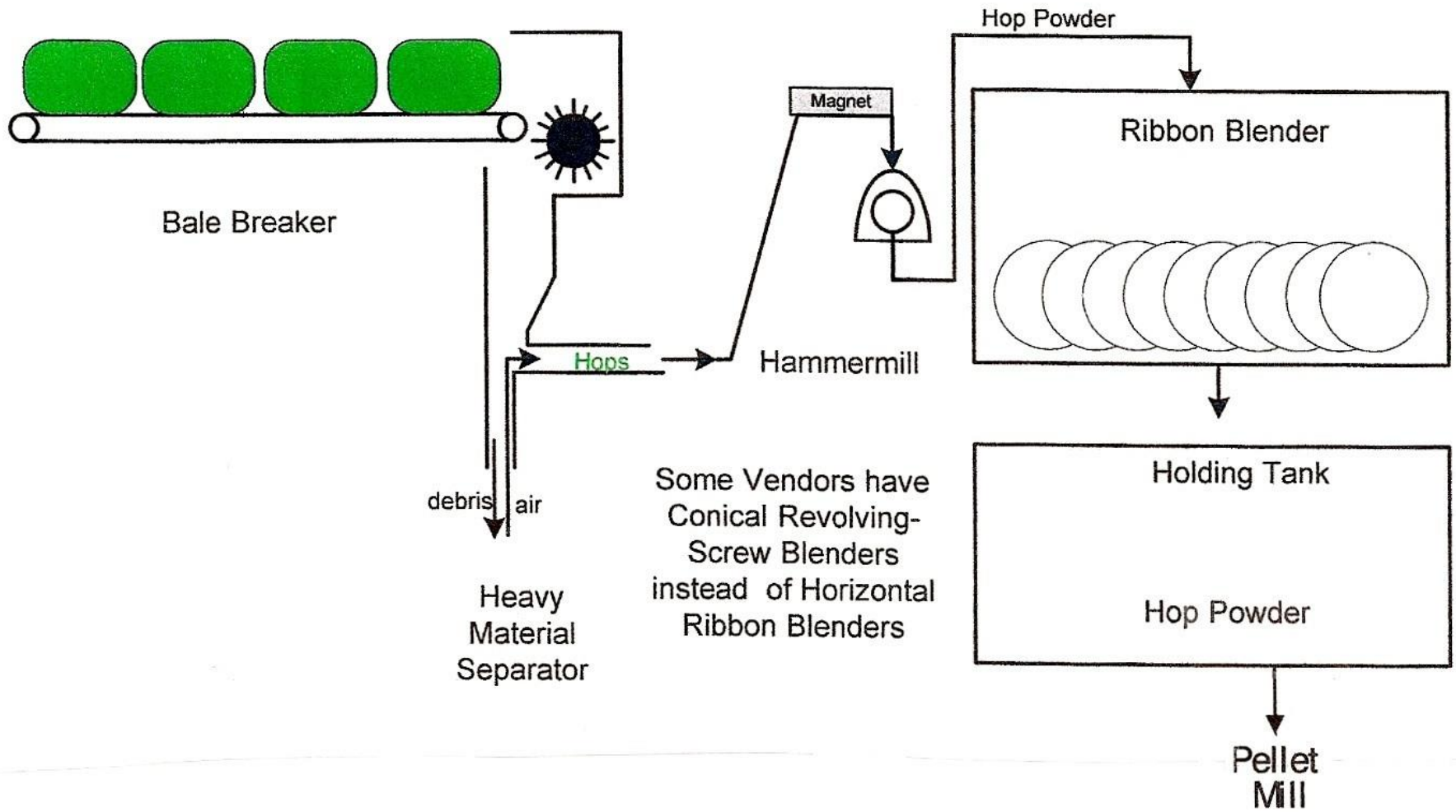
1. No heat abuse of hops, hop powder or pellets during processing.
2. Produce pellets with alpha and oil uniformity to suit the customer.
3. Minimal amount of fines (<2.5% thru 20 mesh screen) in the packaged pellets.
4. Make sure the pellets are sent out in an airtight package. QA program needed to monitor this!

Type 90 Pellets

- Supposedly, 90 refers to the % yield. 100 pd of hops yields 90 lb of pellets. A few % water and some non-hop material (+ stem) lost. Typical yield is 96% not 90%.
- Alpha recovery typically 98%

Type 90 Process





Bale Breaker Platform



Bale Breaker Fingers



Heavy Material Separator



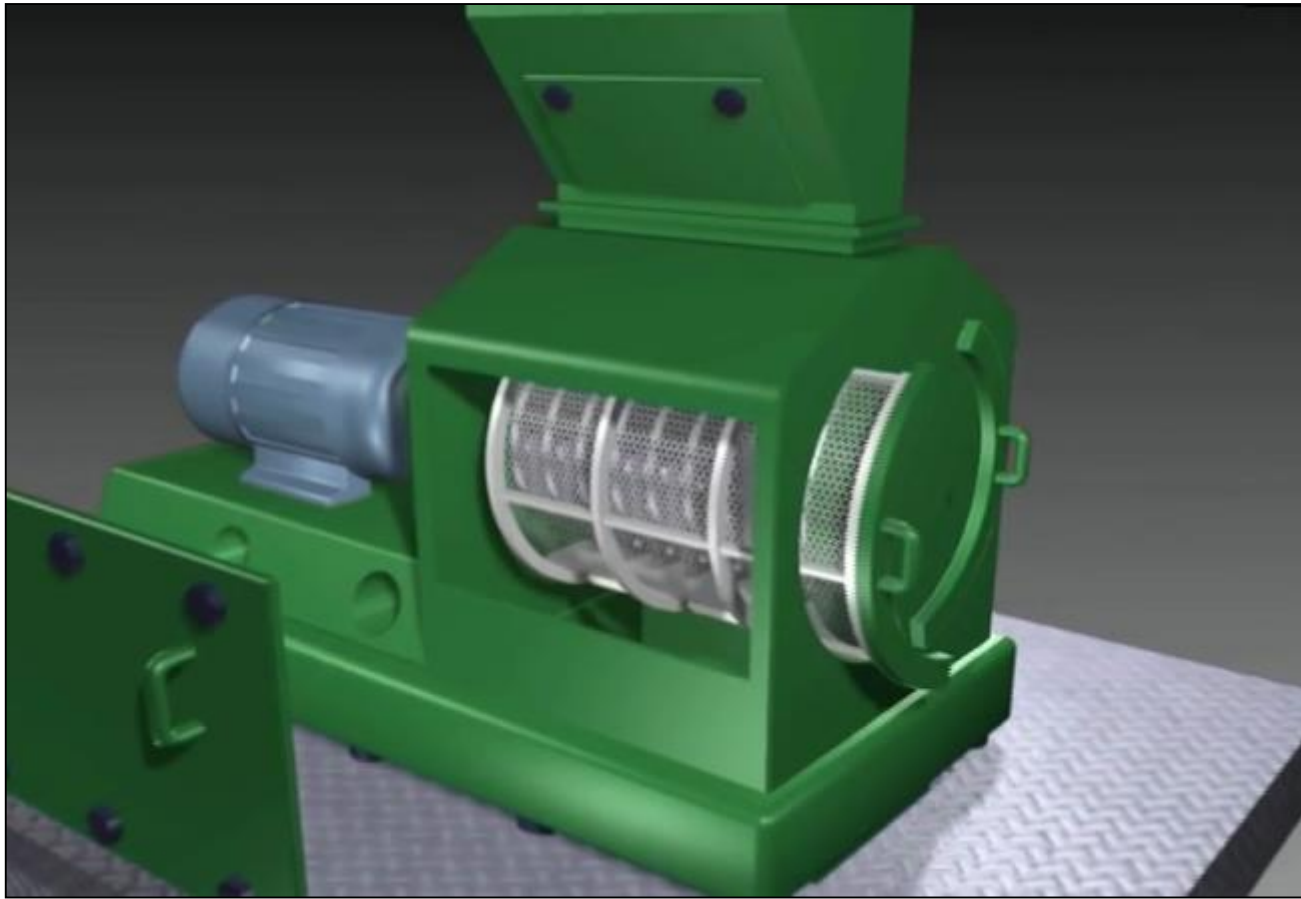
Heavy Material Removed



Hammer Mill



Hammer Mill Screen



Mixing Tank

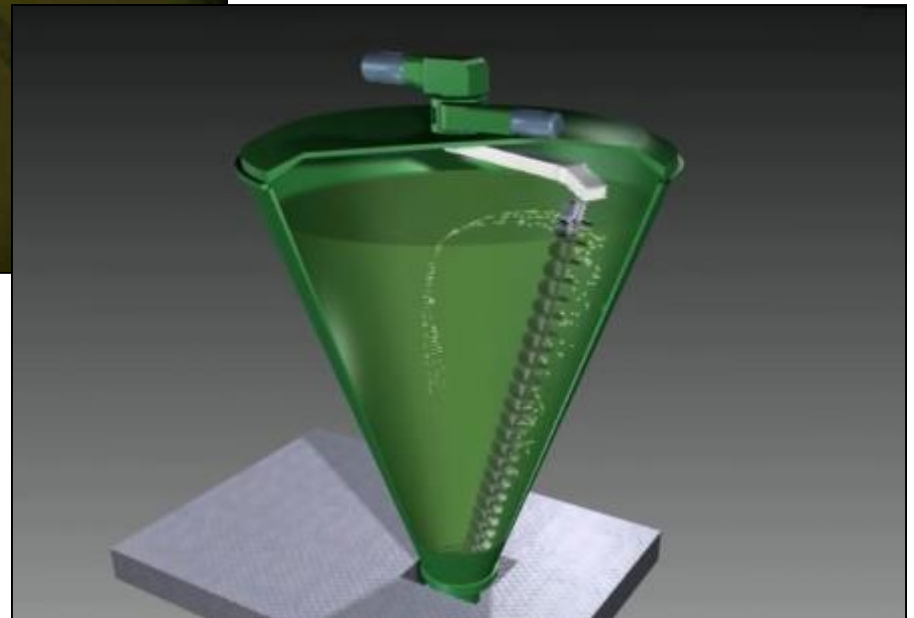
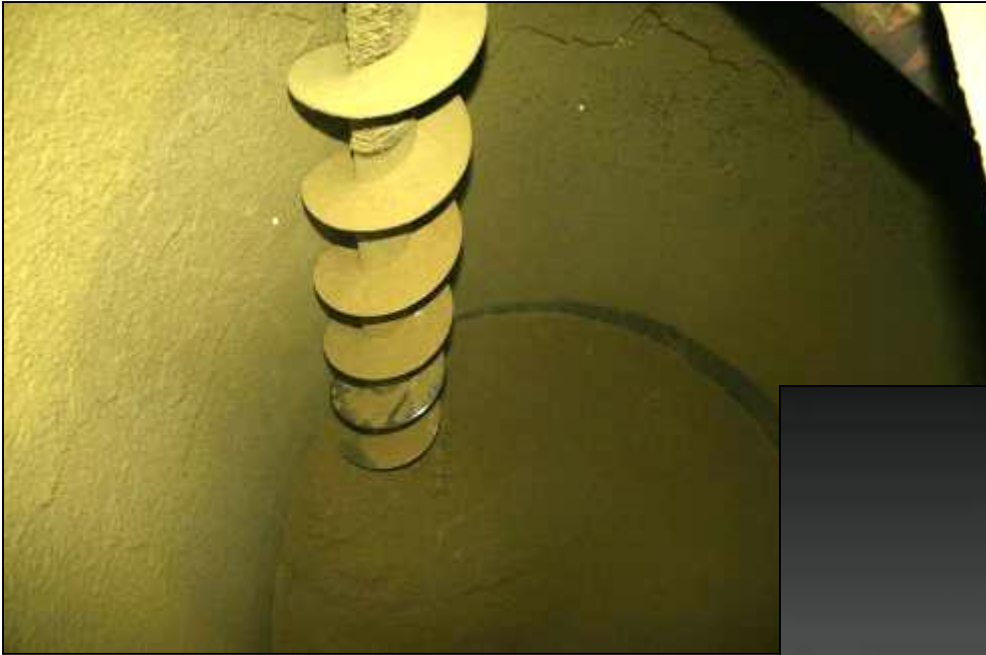
Conical Mixers
give best
uniformity

Some plants use
horizontal
ribbon blenders

- Or may mix
pellets

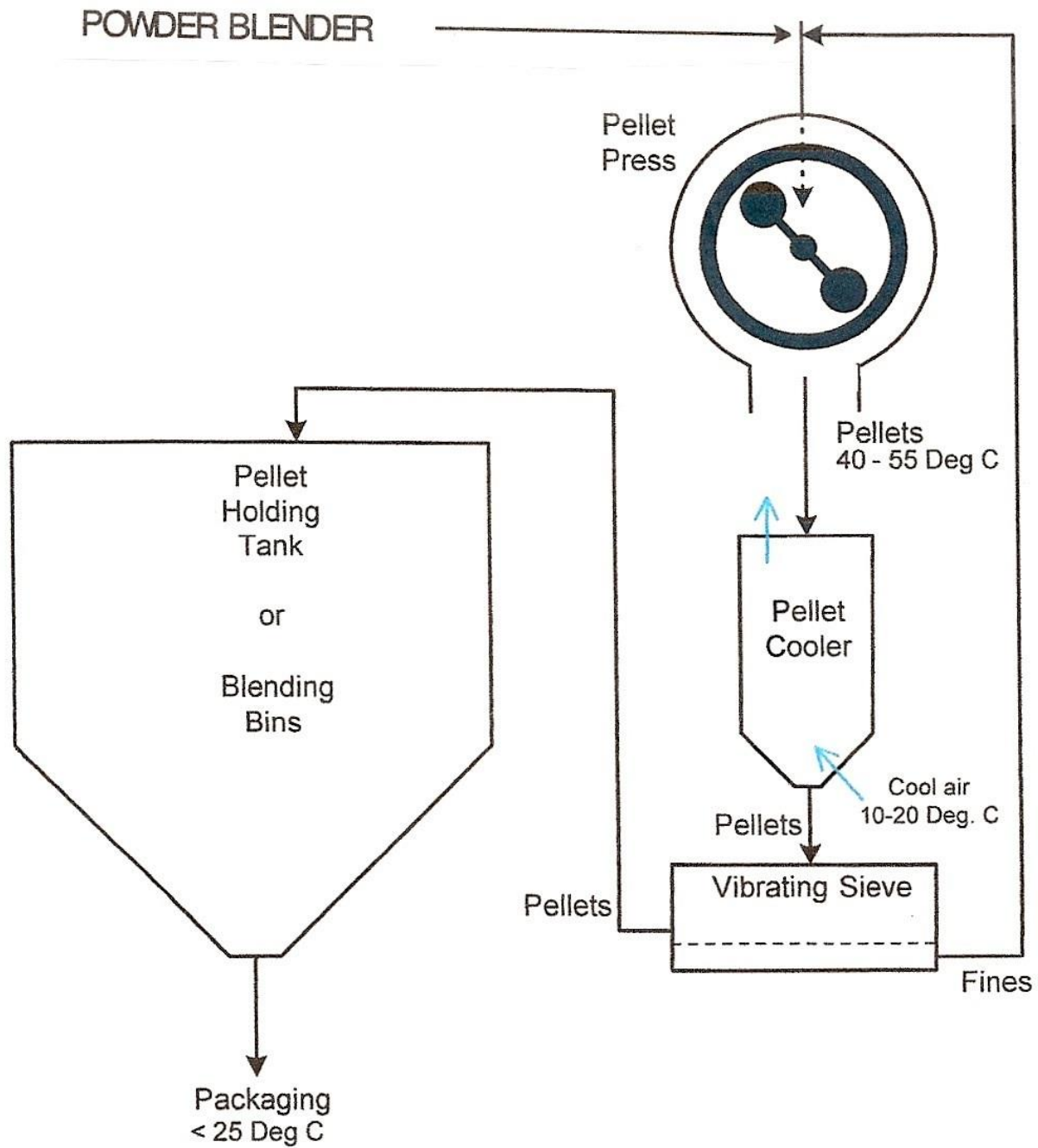


Inside Conical Powder Blender



Pellet Uniformity

- Conical mixer best. Ribbon not so good.
- One German plant mixes pellets instead of powder.
- Some plants mix raw hops as only source of mixing, others do this to supplement mix.
- Combination of ribbon blender and pellet mixing good also.
- Bigger blender = better uniformity



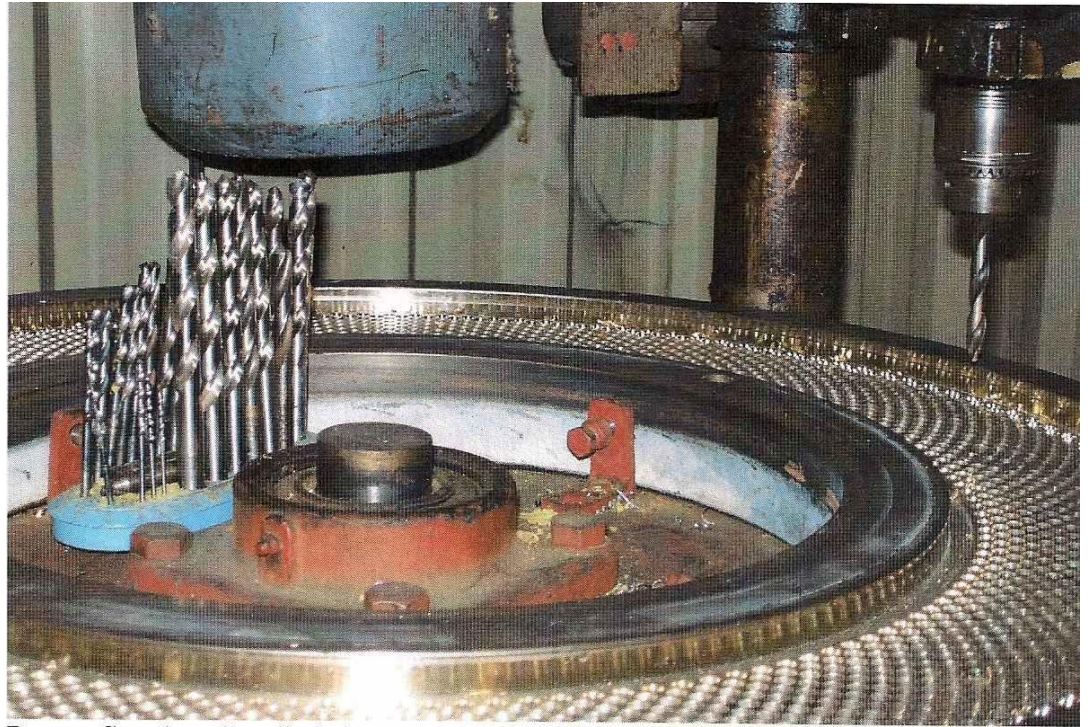
Pellet Press

- Compresses hop powder through a metal die hole (6mm?) to form a solid pellet.
- Temperature control (below 55° C) important.
- Parameters to use are:

die diameter	feed rate
die path length	die geometry
die alloy	die roller clearance

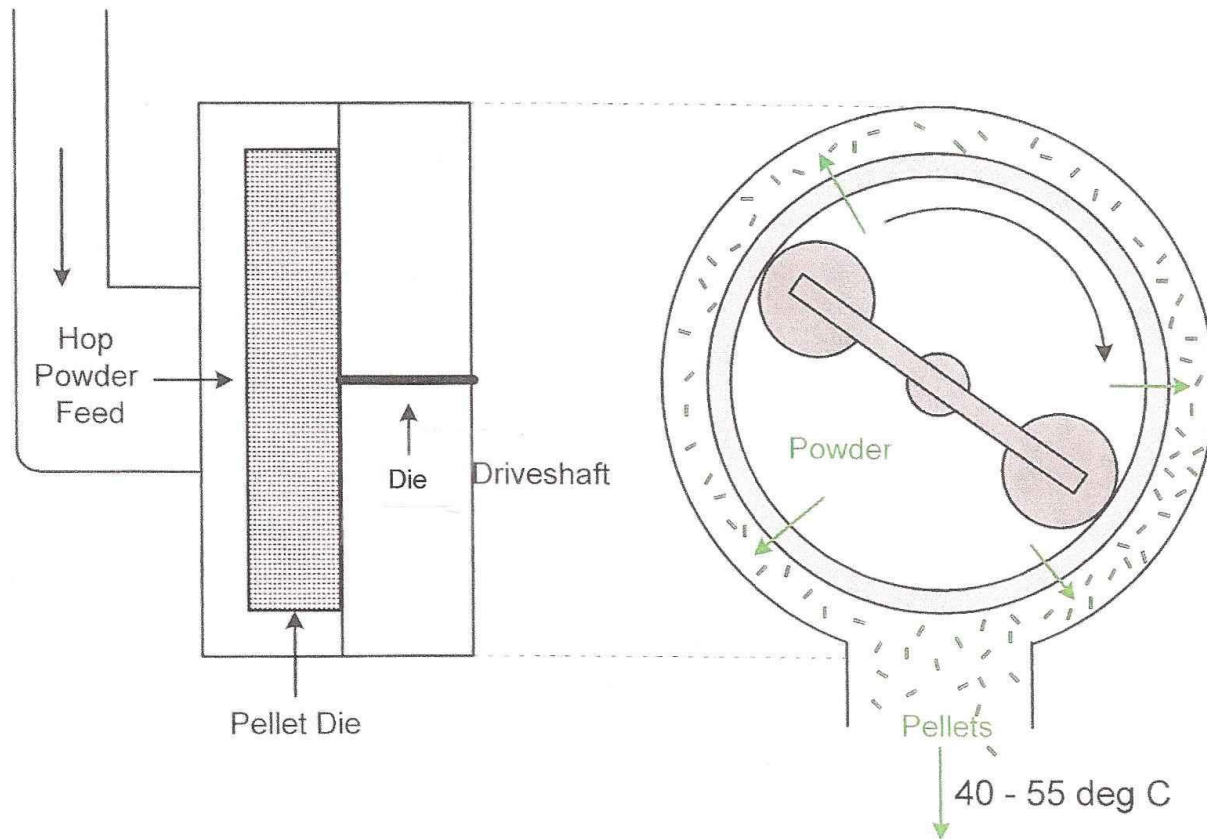
Plate Die

Cylindrical roller rolls at the same speed at outer & inner portion of the die, must skip on outer portion causing friction.



Ring Die Configuration

Rollers don't skip, less friction



Ring Die



Inside a Ring Press



The Pellet Process

- Compression heats up the Powder & melts the α & β -acids. As the pellet cools, these act as a glue to hold the pellet together. (Don't want it too cold!)
- Die diameter and path length are best tools to regulate temperature ($<55^{\circ}$ C)
- When press starts up, die is cold – more friction = scorched pellets. The first 50 -100 lb should be discarded.

Breakout Pellets

When pellets are no longer scorched or glassy, start to collect product.

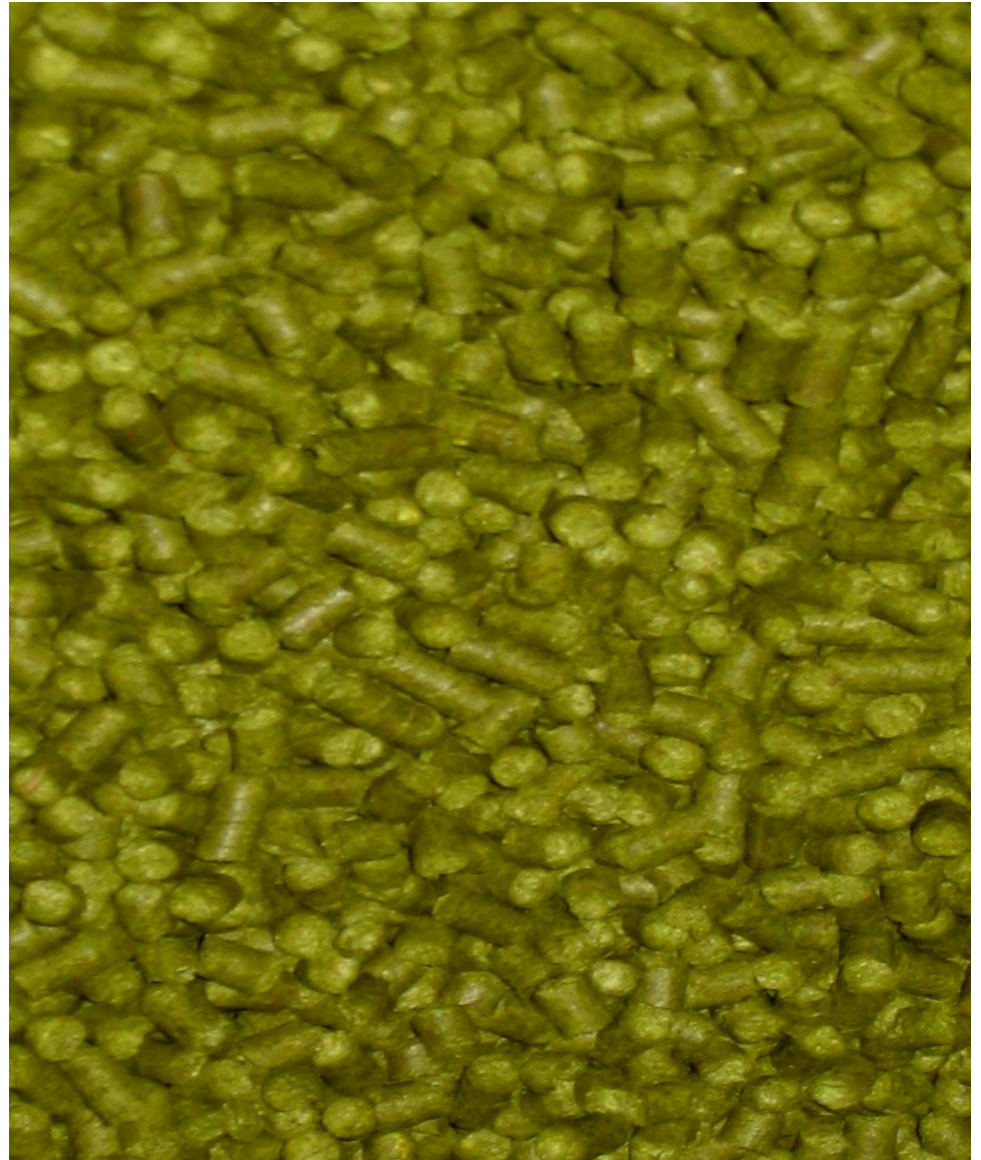


Properly Made Pellets

Green with no glassy or shiny surface. Warm Cookie consistency.

Hops lose $\approx 2\%$ water in process.

0.75% in hammer mill & 1.25% in pellet press.



Monitoring Pellet Temperature

- Can be monitored with an IR temperature sensor or gun.

- Or hold fresh pellets in your hand. If it is painful, they are too hot!

Pain threshold is $\approx 55^{\circ}$ C.

- Pellets should be quickly cooled with air in pellet cooler.

Mechanical Parameters in Pelleting

- 6 mm (1/4 inch) is a fairly widespread standard diameter. Compression & temp. controlled by changing path length. Going larger diameter for troublesome hops ok, as long as enough compression to control bulk density. **460-560g/Liter a good spec.**
- No advantage in going smaller diameter, just makes it more difficult to control process. Why do people do this????

Cooling Die with Liq. Nitrogen

- Some vendors do this to regulate pellet temp.
- Often because they make small diameter pellets – resulting in more friction.
- If mechanical parameters are set correctly, a waste of \$\$ and energy.
- If mechanical parameters are NOT set correctly – makes this harder to detect.
- May cause problems with pellets holding together because too cold to melt alpha.

Pellet Cooler



Pellet Cooling & “Bricks”

- Warm pellets are sticky. If packed warm, especially if vacuum packed, they often clump together so much they require a hammer to break up.
- Will NOT happen with a good vendor. Insist on cooling pellets below 25° C within 10 minutes to avoid oxidation before packing, and must be below 25° C when packed.

Fines Recovery and Recycle

Cooled pellets
are sieved –
fines are
returned to
pellet mill,
pellets sent to
holding bin.



Surge Bins & Pellet Blending

- After cooling & sieving, pellets are either sent to a surge bin to await packaging, or sent to a mixing facility for blending (unusual!)

Pellet Packaging

- Packed in a Mylar bag with a foil Oxygen barrier. Absolutely necessary because lupulin glands are all broken and contents VERY susceptible to oxygen.
- Check oxygen permeability specs of bag.
Want <0.005 cc/100 sq. in. per 24 hr @ 73° F

Pellet Foil Filling Operation



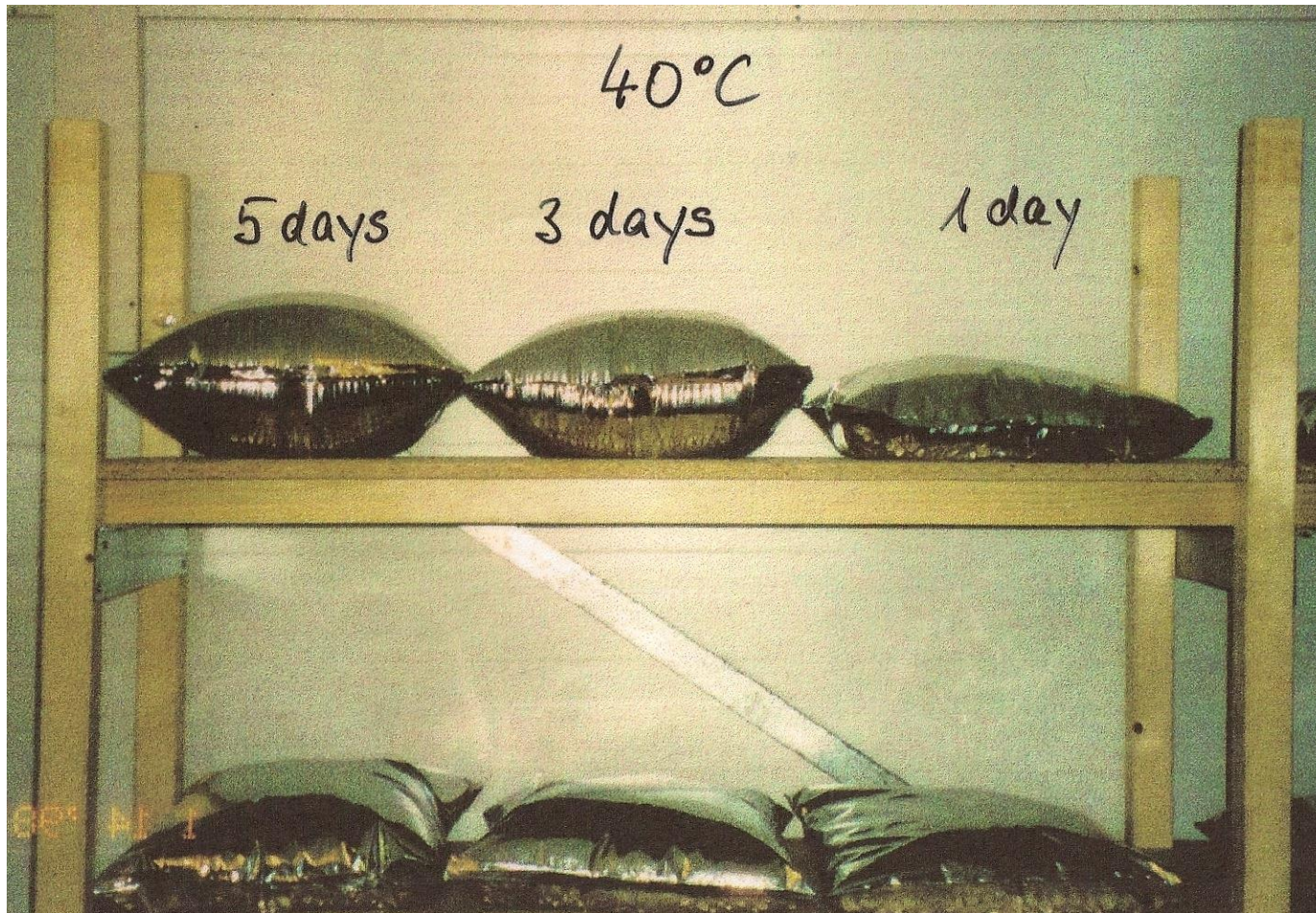
Storage of Hop Pellets

- Vendors recommend storage at refrigerated temperatures and say good for 2 years.
- If stored $< 25^{\circ}$ F, essentially stops all alpha loss! Pellets good for 5 years $< 25^{\circ}$ F if used in kettle. At least 3 years if used for dry-hopping.
- If opened, or foil compromised, store below - 20° F long-term, or $< 40^{\circ}$ F up to 2 weeks, or $< 25^{\circ}$ F up to 5 weeks.

Shipping Hop Pellets

- Temp. & time VERY IMPORTANT – BEWARE!
- At $> 90^{\circ}$ F for more than a few hours, pellet foils may begin to fill with internally generated CO₂ and possibly burst. Happens at a lesser rate down to 75° F. Disaster when this happens!
- DO NOT ship non-temp. controlled containers across the equator! Control temperature in shipping.

Ballooned Pellet Foils



Ballooning????

- Warm pellets generate CO₂ which may burst the foil. Undamaged foils contract when cooled and damage hidden until opened.
- Acetone & many other “solvent-type” chemicals also generated.
- Color changes as well as aroma changes – even if foil NOT compromised.
- NOT a micro-biological problem – not understood!

Vacuum Pack vs. Soft Pack

Susceptible to mechanical damage



Damage harder to detect



Vacuum (Hard) Pack vs. Soft Pack

- Vacuum pack more susceptible to mechanical damage during shipping. But damage may be obvious – if it isn't really ballooning!
- With soft pack, foil partially back filled with CO₂ or N₂ after evacuation of air.
- Soft pack not damaged as easily – but how can you tell? Hold under water – no bubbles?
- Or put in vacuum chamber with CO₂ detector.

Packaging Quality Control

- Even a pinhole air leak in the foil bag will ruin the product before it is used by the brewer.
- The better vendors test about every 50th foil produced on the packaging line to assure there are no problems.
- Some have elaborate machines to test foils.
- At least a simple routine test is needed:

Simple Foil Test Procedure

- Take filled foil and pierce foil with a needle attached to an air pump. Inflate the foil as much as possible. Pull out needle and quickly seal hole with duct tape.
- Submerge foil under water and look for air leaks. Pay special attention to seams you have made.

Hop Pellet Summary

- Maintain temperature 40-55° C in pellet press.
- Cool pellets quickly and pack reasonably quickly.
- Have a QC program to assure foils are sealed correctly.
- Take special care when shipping pellets in warm weather or across the equator.