

No pellet is like the other–

Why SafePellets required more than 20 different types of pellet to investigate the most common safety related issues



SafePellets Workshop – October 14th, 2014



SafePellets



Background



Selection Criteria



Selected Pellets



Conclusions





SafePellets main questions



Where and under which conditions does off-gassing and self-heating from biomass pellets occur?



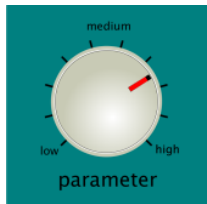
What measures can be undertaken to reduce these risks?



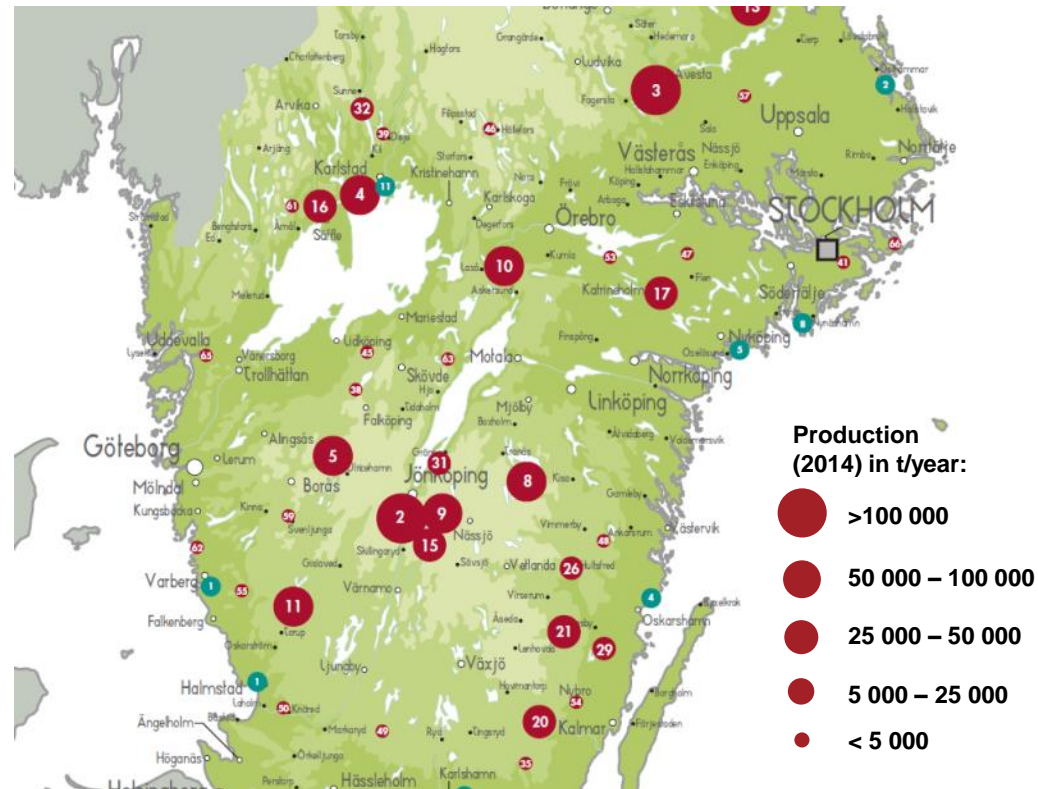
How to approach these questions?

- ◆ Assess the current situation on the pellet market: differences in production and storage, as well as current standards, guidelines and certification schemes
- ◆ Assess the risks (where, how, when, why)
- ◆ Choose pellets to investigate the most common problems, reject or prove hypotheses and identify solutions
- ◆ Develop methodologies for measuring off-gassing and self-heating of pellets
- ◆ Conduct defined storage experiments
- ◆ Draw conclusions and present future scenarios

Pellets selection criteria (common pellets)

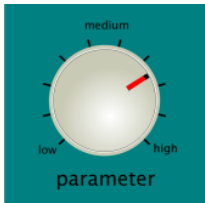


Plant location, size and past incidents



Source: Bioenergi (2014) *PELLETS FABRIKER I SVERIGE 2014*. Available online at www.bioenergidningen.se

Pellets selection criteria (common pellets)



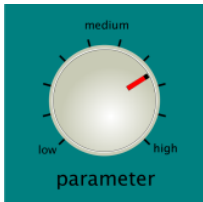
Raw material composition

Raw material	Mass.-% dry basis			
	Cellulose	Hemicellulose	Lignin	Extractives
Pine	48.1	23.5	28.4	3.9
Spruce	43.6	27.4	29.0	1.8
Birch	50.2	32.8	17.0	3.0
Beech	45.2	32.7	22.1	1.1

pine/spruce
ratio

Source: Stanislav V.V. et al. (2012) *AN OVERVIEW OF THE ORGANIC AND INORGANIC PHASE COMPOSITION OF BIOMASS*. Fuel, 94, p. 1-33

Pellets selection criteria (alternative pellets)



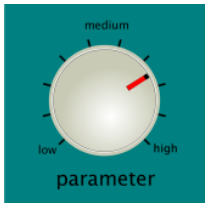
Relevant future raw materials and mixtures

- ◆ Straw
- ◆ Eucalyptus
- ◆ Wine pruning
- ◆ Grape marc



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Pellets selection criteria (purpose-made pellets)



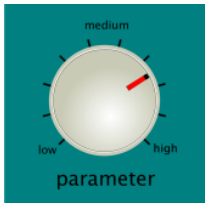
Possible pre-treatments and additives

- ◆ Torrefaction
- ◆ Addition of anti-oxidants as additives
- ◆ Removal of extractives (fatty acids/resin)



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Pellets selection criteria (purpose-made pellets)



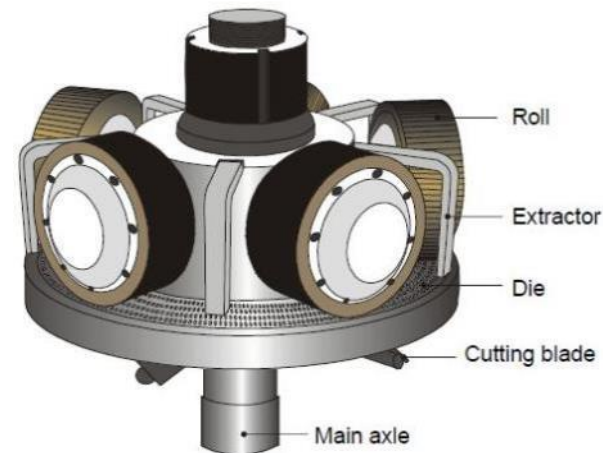
Different pelletising technologies

◆ Ring-die technology



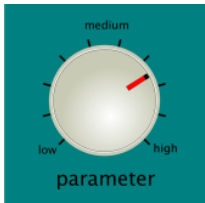
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◆ Flat-die technology



Source: VTT (2002) *Wood pellets in Finland- technology, economy and market* OPET Report 5. Jyväskylä

Pellets selection criteria (purpose-made pellets)



Storage time during production





Common commercial wood pellets

Batch No.	Producer (Country)	Production capacity 2012 (1000t per year)	Pine/spruce ratio (%)	Sampled
5	Germany	150	100/0	Immediately after production
6	Sweden	65	20/80	
8	Germany	130	0/100	
9	Sweden	160	40/60	
10	Sweden ^{a)}	125	60/40	
12	Sweden	105	50/50	

^{a)} indicates same producer



Common pellet production (survey)

	Germany	Sweden	Germany	Sweden	Sweden
Batch no.	5	6	8	9	10
Question					
Was the saw dust stored before pelletizing?	4-5 days, MC 25-30 wt.-%	spruce 3 weeks, pine 2-3 months	no, immediate production	10 days	30 days, MC 55 wt.-%
Was a dryer used for the reduction of moisture content?	3 band dryer, capacity 3t/h each, at 85°C, MC _{final} 10 wt.-%	drum dryer (direct and indirect), capacity 10t/h, MC _{final} 10 wt.-%	Band dryer, capacity 20t/h, at 80°C, MC _{final} 9-11 wt.-%	capacity 42t/h, MC _{final} 10 wt.-%	drum dryer (direct), capacity 16t/h, at 250°C, MC _{final} 10 wt.-%
Do you have a mill for grinding?	3 hammer mills, capacity 6t/h each	hammer mill, capacity 18t/h, mesh size <4mm	hammer mill	no	2 hammer mills, capacity 8t/h each, mesh size <6,5mm



Alternative pellets with high future relevance

Batch No.	Producer (Country)	Production capacity	Raw material composition	Sampled
7	Denmark	Non-commercial producer	83% straw, 11% seed residue, 6% spruce	immed. after production
13	Germany		50% wine pruning, 50% grape marc	immed. after production



Purpose-made pellets

Batch no.	Producer (Country)	Pine/spruce ratio (%)	Production details	Hypothesis Impact of...
1	DBFZ, Germany	100/0 ^{a)}	ground material, stored for 4 days at 20 °C	storage time
2		0/100 ^{b)}	ground material, stored for 8 days at 20 °C	
3		100/0 ^{a)}	pelletized immediately after grinding	
4		0/100 ^{b)}	pelletized immediately after grinding	

a,b,c or d) indicate same raw material batch



No pellet is like the other



Almost 30 different types of pellet were necessary to:

- Represent a wide range of commercially available and common wood pellets
- Get a feel for alternative pellets and their potential for the future
- Investigate available pre-treatment technologies
- Include different production scenarios (e.g. storage time and pelletising technology)



SafePellets main questions



Where and under which conditions does off-gassing and self-heating from biomass pellets occur?



What measures can be undertaken to reduce these risks?

My colleagues **may** have ~~all~~ the answers...



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