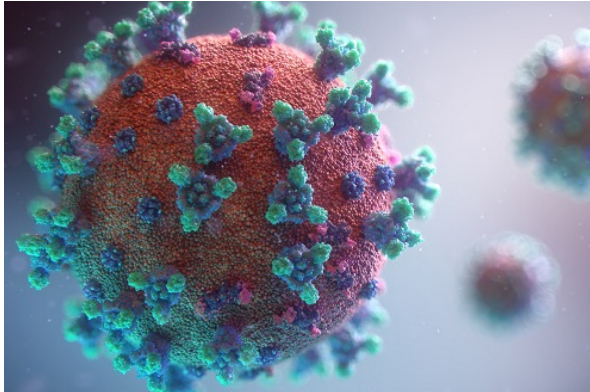




Barbora Dubovcova, Food Safety manager, Bühler AG

Reduction of microbial contamination on dry food ingredients by **Low-energy electron beam**



Global food safety megatrends.

- COVID19 causes postponed harvest, long storage, lack of inspection, online food delivery
- Fresh and minimally processed convenience foods
- Alternative raw materials that need flavor ingredients



Microbial contamination in **dry foods**

Complex, global supply chain

Total microbial load can be as high as 100,000,000 CFU/g

Prevalence of *Salmonella* in imported spices to the USA up to 18%²

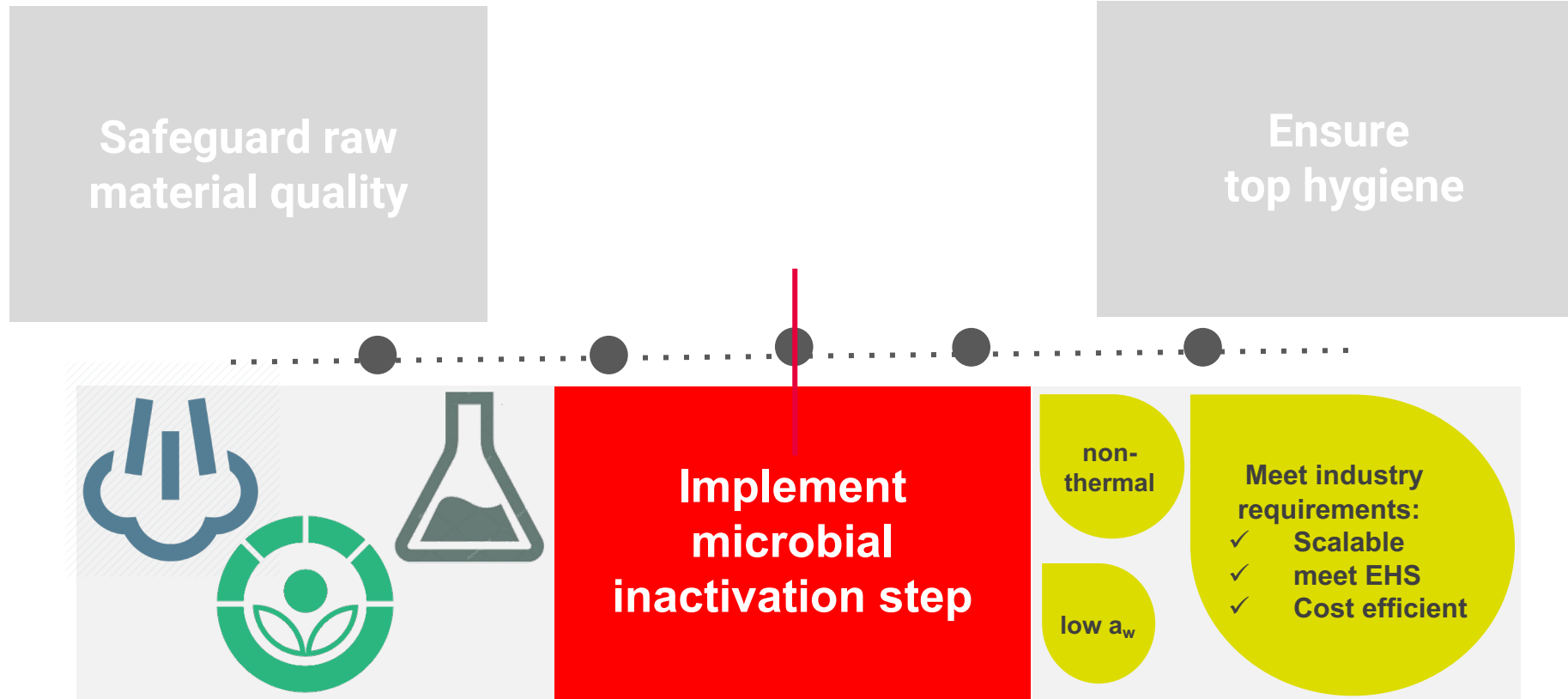
Example of industry requirements of a *clean* black peppercorn

Total mesophilic count	<100,000 - 10,000	CFU/ g
Coliforms	<100	CFU/ g
<i>Salmonella spp.</i>	No presence	/ 25 or 375 g
<i>E.Coli</i>	No presence	/ g
Mold and yeast	<100	CFU/ g
Aerobic bacterial spores	<1000-100	CFU/ g
Aroma, flavor	fresh, typical for the product	
Appearance, color	uniform typical color	
Moisture	typical for the product	





Approach to the contamination

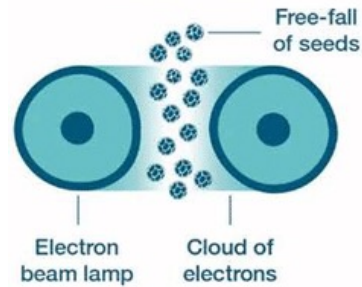




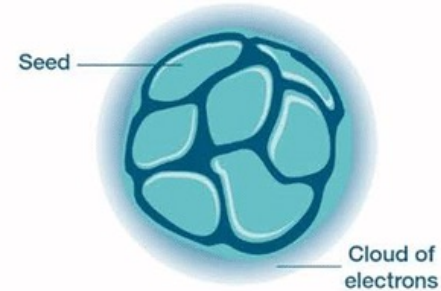
Laatu

Powered by Low-energy electron beam technology.

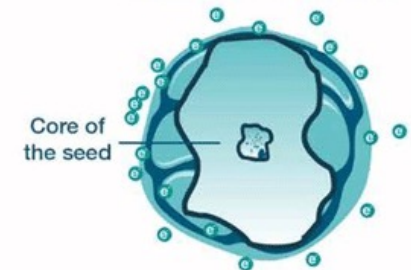
Microbial reduction in milliseconds

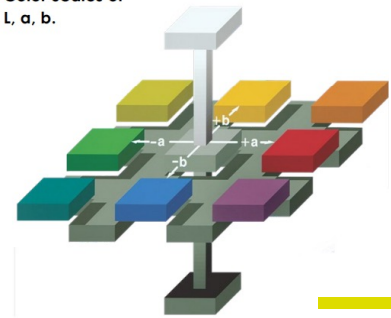


Treatment of the surface



Minimal or no impact to internal structure





Impact on color.

LEEB preserves food color better than steam treatment.

Black peppercorn

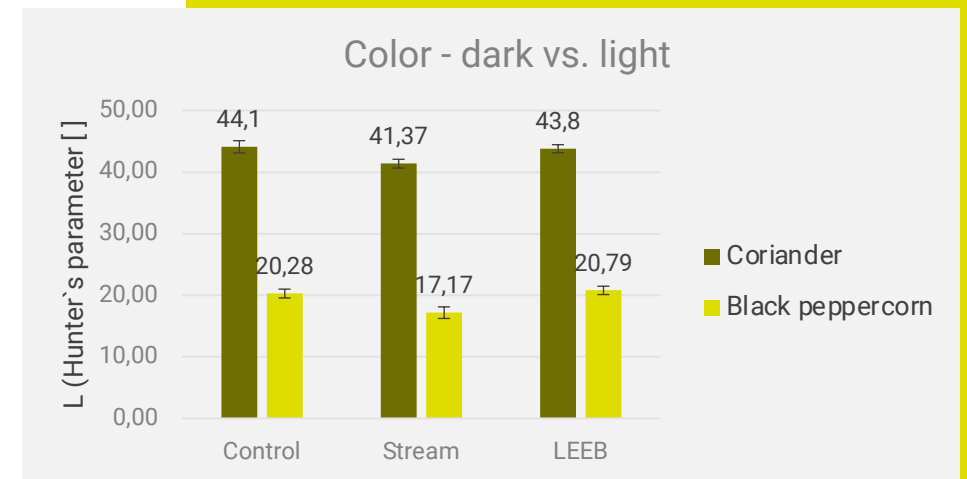
Color of LEEB-treated pepper is not significantly different to the Control sample. The color is typical light dark, without changes in the other tones. Steam-treated pepper is darker than the control.

Coriander

LEEB-treated coriander is also not significantly different when compared to the untreated Control. Coriander treated with steam is darker and has a slightly more yellow tone.

Coriander			
Hunter's parameter	Control	Stream	LEEB
ΔE	0 a	3.04 b	0.56 a

Black peppercorn			
Hunter's parameter	Control	Stream	LEEB
ΔE	0 a	3.48 b	0.65 a





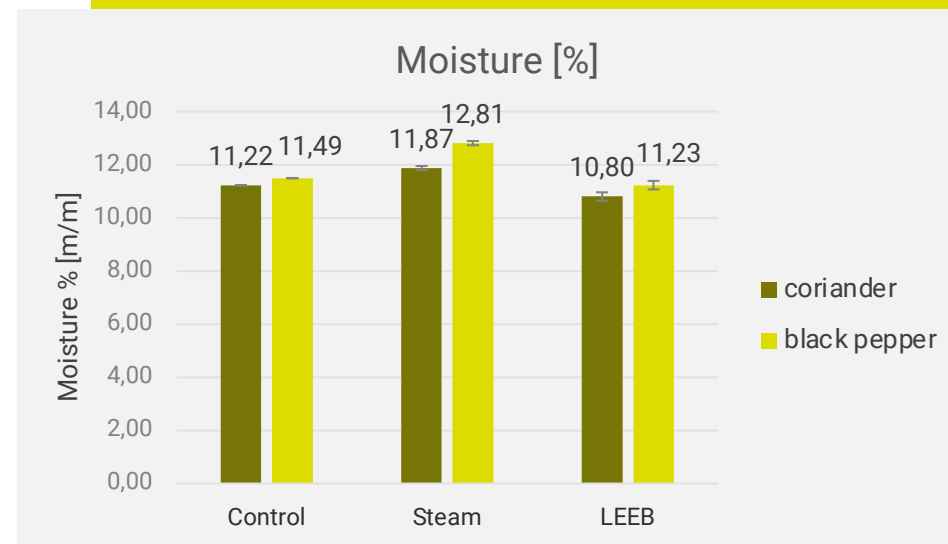
Impact on moisture.

LEEB keeps the food moisture level low.

LEEB treatment preserves the original moisture level of coriander and black peppercorn better than the steam treatment. Steam treatment introduces water to dry food matrices which increases the risk of contamination with *Listeria* and molds.

Coriander			
Moisture %	Control	Steam	LEEB
	11.22 a	11.87 b	10.80 c

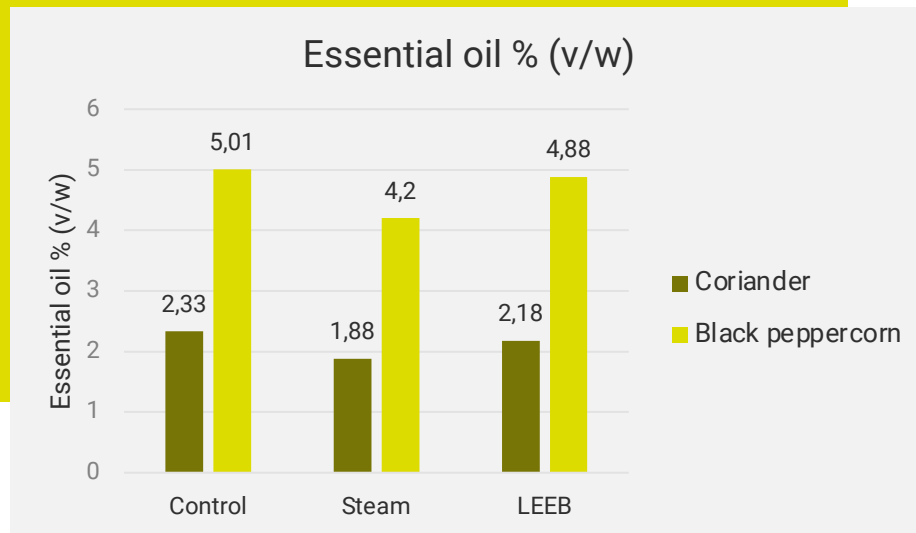
Black peppercorn			
Moisture %	Control	Steam	LEEB
	11.49 a	12.81 b	11.23 c





Coriander			
Essential oil % (v/w)	Control	Steam	LEEB
	2.33 a	1.88 b	2.18 a

Black peppercorn			
Essential oil % (v/w)	Control	Steam	LEEB
	5.01 a	4.2 b	4.88 a

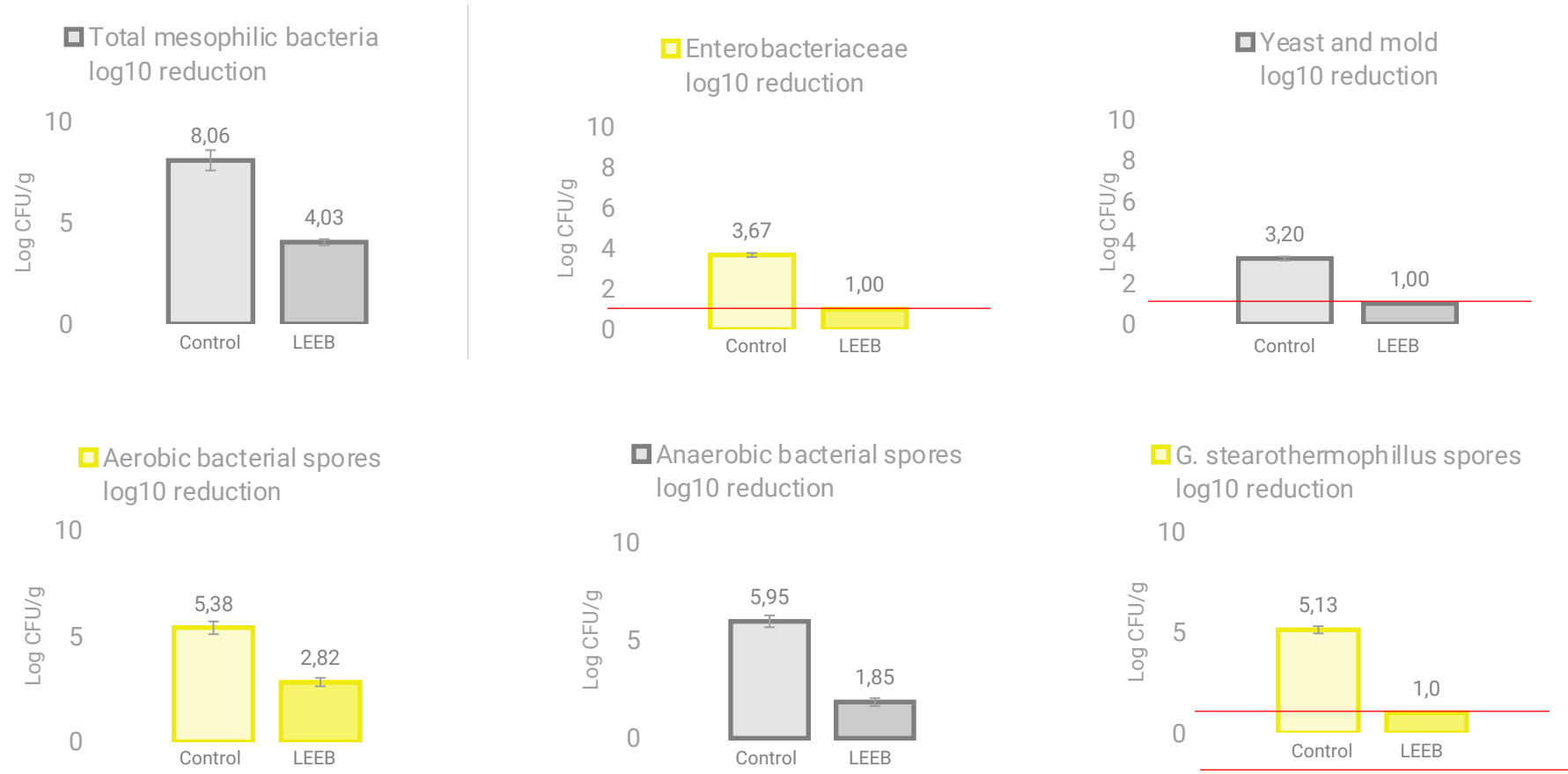


Impact on essential oils.
LEEB preserves the essential oils better than steam treatment.

LEEB treatment preserves the original level of essential oils in coriander and black peppercorn while Steam treatment reduces their level.



Impact of LEEB on microbial reduction Black peppercorn.





Consideration for process validation

- According to the FSMA, PPC(CCP) validated and regularly verified
- Possible when the process is controllable, conditions are measurable
- Work with surrogates to avoid cross-contamination in the facility
- Industry, practical considerations =>

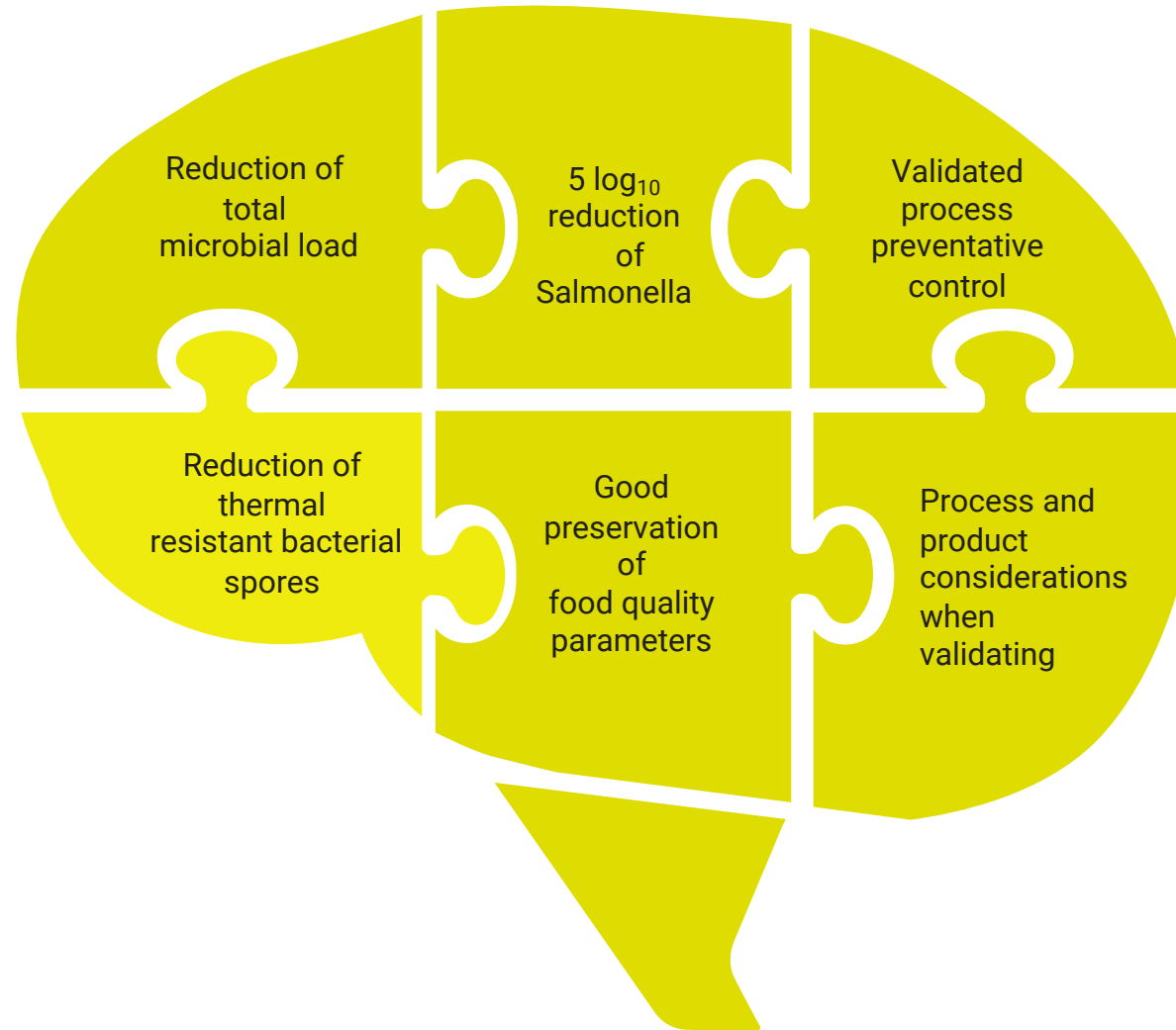
Some Process & product considerations

- Process main characteristics
- Impact of process parameters on the performance
- Cold & hot spot definition
- Matrix – shape, size, composition, moisture..
- Most resistant pathogen & Surrogate selection and compatibility
- Inoculum preparation, inoculation method for industrial quantities
- Stability of inoculated matrix during on-site validation
- SOP repeatability by the commercial labs



Take-home message.

Low-energy electron beam technology.



Other LEEB presentations:

Mirjad Keka

Head of Business development, Bühler AG

Low-energy electron beam (LEEB) – A game-changing microbial reduction technology with minimal impact on quality

Dr. Matthew Murdoch

Irradiation expert, Bühler UK

Challenges of simulations of low energy electrons for surface irradiations

IFIS 2021

Thanks.



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